

**THE REVIEW
OF APPLIED
ENTOMOLOGY.**

**SERIES B: MEDICAL
AND VETERINARY.**

**VOL. 27.
(1939.)**

**ISSUED BY THE IMPERIAL
INSTITUTE OF ENTOMOLOGY.**

LONDON:
THE IMPERIAL INSTITUTE OF ENTOMOLOGY,
41, QUEEN'S GATE, S.W.7.

1940.

All Rights Reserved.

IMPERIAL INSTITUTE OF ENTOMOLOGY.

Executive Council.

F. J. DU TOIT, *Chairman*, Union of South Africa.

Sir DONALD FERGUSSON, K.C.B., United Kingdom.

Dr. WILLIAM ALLEN, Canada.

F. L. McDougall, C.M.G., Australia.

NEVILL L. WRIGHT, F.I.C., D.I.C., New Zealand.

J. M. ADAMS, F.R.C.Sc. (I), Eire.

D. JAMES DAVIES, C.B.E., Newfoundland.

SHAMALDHARI LAL, India and Burma.

B. F. WRIGHT, Southern Rhodesia.

J. A. CALDER, C.M.G., Colonies, Protectorates and Mandated Territories.

Sir DAVID CHADWICK, K.C.M.G., C.S.I., C.I.E., *Secretary*.

Director.

Sir GUY A. K. MARSHALL, C.M.G., F.R.S.

Assistant Director and Editor.

Dr. S. A. NEAVE, O.B.E.

Assistant Director and Superintendent of Farnham House Laboratory.

Dr. W. R. THOMPSON, F.R.S.

Head Office—British Museum (Natural History), Cromwell Road,
London, S.W.7.

Publication Office—41, Queen's Gate, London, S.W.7.

ERRATA.

- Page 17 line 14 for " *Blatella* " read " *Blattella* "
,, 34 8 lines from end for " *A. langeroni* " read " *P. langeroni* "
,, 35 line 13 for " MARTINS (A. M.) " read " MARTINS (A. V.) "
,, 47 lines 5 and 17 for " **17** " read " **16** "
,, 115 17 lines from end for " when " read " where "
,, 128 4 lines from end for " *Lyponyssus* " read " *Liponyssus* "
,, 146 18 lines from end for " third " read " second "
,, 162 line 19 for " *bubalus* " read " *bubalis* "
,, 225 lines 18 and 19 for " D. K. Das " read " B. K. Das "
,, 245 line 11 for " MANGABEIRA FILHO (D.) " read " MANGABEIRA
FILHO (O.) "
,, 248 line 2 for " JELLISON (W. J.) " read " JELLISON (W. L.) "

IMPERIAL INSTITUTE OF ENTOMOLOGY.

REVIEW
OF
APPLIED ENTOMOLOGY.
SERIES B.

VOL. 27.

1939.

OMORI (N.). Experimental Studies on the Influence of low Temperatures upon the tropical Bed Bug (*Cimex hemipterus* Fabricius). Fourth Report. On the Influence of a Temperature of 0°C. [In Japanese.] —*J. med. Soc. Formosa* **37** no. 6 (no. 399) pp. 1004-1015. Taihoku, June 1938. (With a Summary in English.)

In continuation of previous experiments [*cf. R.A.E., B* **24** 254], eggs, nymphs and adults of *Cimex hemiptera*, F., that were being reared in an incubator at 27°C. [80·6°F.] with a relative humidity of about 75 per cent., were exposed for various periods to a temperature of 0°C. [32°F.] with a relative humidity ranging from 60-100 per cent. and then returned to the incubator. The eggs were divided into five groups, in which the incubation periods before exposure were 4-5, 3-4, 2-3, 1-2 and 0-1 days, respectively. Some eggs of each group survived exposure for 7 days and, although they did not develop during this period, almost all developed to a slight extent after being returned to the incubator. All except one, however, failed to hatch. All eggs exposed for 14 and 21 days died during or soon after exposure without further development, with the exception of one exposed for 14 days that developed slightly when returned to the incubator. Batches of nymphs of the last four instars, both fed and unfed, were all dead after an exposure of 7 days. Of the two batches of first-instar nymphs, 14 out of 30 fed examples and all of 30 unfed examples survived, although nymphs were least resistant to other low temperatures in this instar [*cf. 23* 226; *24* 254]. Some of the fed adults of both sexes survived exposure for 7 days, and the virility of the males was unimpaired. All males exposed for 14 or more days died during exposure. Of 16 females that had not been able to oviposit because pairing had taken place only 2 days before exposure, only 1 survived exposure for 7 days and it died 3 days after transfer to the incubator. Of 14 females that had been able to oviposit because pairing had taken place 5 days before exposure, 2 survived exposure for 7 days and, in the incubator, laid 149 and 141 eggs, respectively, of which 60 and 20 hatched. Spermatozoa received by the females of these two batches remained viable during exposure and for 11 and 6 days, respectively, after transfer to the incubator.

OMORI (N.). Experimental Studies on the Influence of Low Temperatures upon the Common Bed-Bug (*Cimex lectularius* Linnaeus). First Report. On the Influence of a Temperature of 0°C. [In Japanese.]—*J. med. Soc. Formosa* **37** no. 7 (no. 400) pp. 1081–1103, 12 refs. Taihoku, July 1938. (With a Summary in English.)

In these experiments on the effects of exposure of eggs, nymphs and adults of *Cimex lectularius*, L., to a temperature of 0°C. [32°F.], the technique was similar to that used with *C. hemiptera*, F. [see preceding paper], except that the temperature in the incubator was 26.5°C. [79.7°F.] and that some of the nymphs and adults were allowed to remain at 0°C. [32°F.] and were examined at weekly intervals until they were found to be dead. The eggs were divided into five groups, in which the incubation periods before exposure were 4, 3, 2, 1 and 0 days. The percentages of eggs hatching in each group, respectively, after exposure for 7 days were 93, 88, 48, 76 and 64 and after exposure for 14 days 0, 0, 12, 60 and 4; no eggs hatched in any group after exposures of 21 and 28 days. Embryonic development was suspended during exposure, the period required for incubation at 26.5°C. being approximately the same as for eggs not exposed to cold. In almost all nymphs of the last four instars, activity had ceased in fed examples after an exposure of 3 weeks and in unfed examples after an exposure of 4 weeks. Fed first-instar nymphs survived exposure for more than 49 days and unfed ones for as long as 154 days. Some fed adults lived for more than 175 days. The virility of two pairs of males that survived exposure for 7 and 14 days, respectively, was unimpaired. Two of a group of 16 females that had not been able to oviposit because pairing took place only two days before exposure and two of 13 that had been able to oviposit because pairing took place 5 days before exposure survived an exposure of 7 days, but one in each group died on the day following removal to the incubator. The other two deposited, respectively, 303 and 28 eggs, of which 255 and 21 hatched. The spermatozoa remained viable in the bodies of females of these two batches during the period of exposure and for 52 and 2 days, respectively, after transfer to the incubator.

DEL PONTE (E.). Las especies argentinas del género *Cochliomyia* T. T. (Dipt. Muse.). [The Argentine Species of the Genus *Cochliomyia*.]—*Rev. Ent.* **8** pt. 3–4, pp. 273–281, 2 figs., 16 refs. Rio de Janeiro, 25th June 1938.

In view of the importance of the question of the occurrence and economic status of *Cochliomyia hominivora*, Coq., in Argentina, the author discusses the synonymy of this and allied species on the basis of data in the literature and examination of examples of *C. americana*, Cushing & Patt., and *C. macellaria*, F., received from Cushing, and microscopic preparations of *C. lynchi*, Lah. He agrees with Aubertin & Buxton [*R.A.E.*, B **23** 11] in regarding *C. macellaria* and *C. hominivora* as distinct and *C. americana* as identical with the latter, but considers *Musca laniaria*, Wied., to be a synonym of *C. macellaria*, and proposes the name *C. aldrichi*, sp. n., for the fly described as *C. laniaria*, Wied., by Aldrich [**13** 68]. He also regards *C. lynchi*, which was reared from larvae infesting a calf in the Argentine Chaco, as a synonym of *C. macellaria*. He has observed

C. hominivorax in Argentina in occasional cases of myiasis in man and animals, and *C. macellaria* in the open air or on meat or carcasses. *C. hominivorax* was never attracted to baits of fresh meat.

BORGSTROM (F. A.). *Studies on Experimental Cochliomyia americana Infestations with special Reference to the Bacterial Flora and the Development of Immunity*.—*Amer. J. trop. Med.* **18** no. 4 pp. 395-411, 10 refs. Baltimore, Md, July 1938.

In experimental infestations of guineapigs with *Cochliomyia hominivorax*, Coq. (*americana*, Cush. & Patt.), it was found that eight was the maximum number of larvae that could be tolerated without fatal results. Previously uninfested guineapigs (400-450 gm.) almost always died when infested with nine maggots and invariably did so when infested with ten or more. Since the destruction of tissue seemed entirely inadequate to account for the serious effects produced, it was thought that these must be due to bacteria associated with the infestation, or to metabolic or toxic products of the larvae formed during their activity in the wound. The experiments described were carried out to determine the nature and degree of any immunity to subsequent infestations produced by sublethal infestations with eight larvae. Artificial wounds were made by removing a small circular area of skin on the shoulders of guineapigs. Reinfestations were made with batches of 20 larvae, since this number was invariably fatal to normal medium-sized animals by the fifth or sixth day, but was not so large as to conceal any immunising effect produced by the first infestation.

The following is substantially the author's summary: The development of an immunity was demonstrated by the fact that guineapigs reinfested after an interval of 20 days were able to survive the injurious effects of a number of larvae that proved lethal to a normal guineapig within 5 days. There was a reduction in the number of larvae that succeeded in establishing themselves when placed in a wound on a previously infested animal, but larvae that were present after 24 hours grew and developed in a normal manner. Thus, interference with nutrition is not a factor in the immunity. It is suggested that the proteolytic activity of the accompanying bacteria may in some way be concerned. Guineapigs in which wounds were smeared daily for 5 days with exudate from infested lesions showed the same ability as previously infested animals to survive infestation by a normally lethal number of larvae after an interval of 20 days. It was found that the immunity was not due to acquired resistance to the accompanying bacteria. It is confined to the area previously infested, animals reinfested after 20 days on the opposite shoulder being unable to survive infestation by a lethal number of larvae. The duration is 20-40 days; guineapigs reinfested on the same area after 40 days showed slight evidence of immunity, since they died in 5-10 days instead of succumbing by the fifth day. Attempts to immunise guineapigs by subcutaneous and intraperitoneal injections of suspensions of dried and pulverised larvae were negative, except that a local immunity was produced by subcutaneous injections sufficient to delay death for several days in animals subsequently infested in the same areas. A single species of gram-negative bacillus was found to be invariably associated with lesions of *C. hominivorax* and to be the only species present after the first 24-48 hours; it is here described

as *Proteus chandleri*, sp. n. It apparently plays no part in the production of immunity, since guineapigs immunised both locally and generally against it readily succumbed to an infestation of 20 larvae.

WHEELER (C. M.). Progress of Spirochaete Infection in the Developmental Stages of the Host Tick, *Ornithodoros hermsi*, Wheeler.—*Amer. J. trop. Med.* **18 no. 4 pp. 413–419, 3 charts, 10 refs. Baltimore, Md., July 1938.**

An account is given of experiments on hereditary transmission in *Ornithodoros hermsi*, Wheeler, of spirochaetes of relapsing fever in California, some of which have already been noticed [cf. *R.A.E.*, B. **24** 207].

The following is the author's summary : From the above series of experiments it has been demonstrated : (1) that hereditary transmission of spirochaetes of California relapsing fever was effected through a small percentage (0.29 per cent.) of the progeny of infective female ticks ; (2) that from 35 per cent. to 48 per cent. of non-infective ticks when allowed to feed as larvae on infected laboratory white mice were able to acquire the spirochaetes and transmit them to normal animals in some one or all of the subsequent developmental stages ; (3) that clean larval ticks produced by a female tick taken at Lake Tahoe were able to acquire the relapsing fever spirochaetes from a white mouse previously infected through the bite of an infected tick taken at Big Bear Lake, some 400 miles distant [cf. *loc. cit.*], and were able to transmit these spirochaetes to clean white mice.

LARSON (C. L.) & GREEN (R. G.). Seasonal Distribution of Tick Parasites.—*J. Parasit.* **24 no. 4 pp. 363–368, 5 refs. Lancaster, Pa., August 1938.**

The studies described were undertaken in 1935 to determine the seasonal distribution of *Ixodiphagus texanus*, How., in Morrison County, Minnesota, and the stages of rabbit tick (*Haemaphysalis leporis-palustris*, Pack.) that are parasitised by it [cf. *R.A.E.*, B **26** 44] ; 7,566 engorged immature ticks (3,115 nymphs and 4,451 larvae) collected from 139 snowshoe hares between 2nd April and 22nd November 1935 were kept under observation. Parasites emerged from 3.3 per cent. of the nymphs and 7.4 per cent. of the larvae. Both nymphs and larvae were parasitised during the greater part of the tick season ; the fact that parasites were obtained from both stages taken on 24th April, soon after the immature ticks first made their appearance, indicates that *I. texanus* is able to overwinter in either engorged or unengorged immature ticks. The percentage of ticks parasitised was greatest in August and September, the months when the adult parasites emerged ; the last parasitised ticks were found on 5th October. It seems probable that the parasite has only one generation a year. In a group of parasitised ticks in which counts were made, averages of 5.4 and 2.1 parasites emerged from nymphs and larvae, respectively. The ratios of males to females among parasites emerging from larvae and nymphs were approximately 1 : 1 and 1 : 5, respectively. The effect of *I. texanus* in controlling ticks in this area does not appear to be significant.

EWING (H. E.). The scientific Name of the common North American Chigger preoccupied.—*Proc. helminth. Soc. Wash.* **5** no. 1 pp. 26–27. Washington, D.C., January 1938.

A. C. Oudemans has recently pointed out (1937, *Krit. Hist. Overz. Acarol.*, pt. 3 p. 1389) that in 1847 Lucas described a "patatta" mite (chigger) taken on man in Brazil as *Leptus irritans*, which he considers a synonym of *Trombidium batatas*, L. Hence the name *L. irritans*, Riley, is preoccupied. Linnaeus' description is unrecognisable, and that of Lucas is unidentifiable with any species to-day. Lemaire's description (in Murray (A.), *Economic Entomology*, 1877, p. 113) of a mite, found infesting a girl in France, though thought to be of Mexican origin, as *Tetranychus tlalsahuate*, shows it to be a synonym of *Trombicula autumnalis*, Shaw. In 1910, Oudemans (*Ent. Ber.* 3 p. 847) described a chigger taken on man in Mexico as *Microthrombidium alfreddugèsi*, and accordingly the name of the common North American chigger becomes *Trombicula alfreddugèsi*, Oudm., of which *Trombicula cinnabarinus*, Ewing, and *Leptus similis*, Hirst, are synonyms [cf. *R.A.E.*, B **12** 65].

HEARLE (E.). Insects and allied Parasites injurious to Livestock and Poultry in Canada.—*Publ. Dep. Agric. Canada* no. 604 (Ent. Bull. no. 33), 108 pp., 83 figs. Ottawa, Ont., March 1938.

This publication on Arthropods affecting domestic animals and poultry in Canada is based on a previous bulletin [*R.A.E.*, B **12** 27] now out of print, but incorporates recent additions to knowledge of this subject and is much more detailed. The first part of the paper deals briefly with the ways in which Arthropods injure stock and in a general manner with the means that may be employed to control them. The bionomics of the more important species are then described, and more specific methods for their control are recommended. Sections on the various types of flies again occupy the greater part of the bulletin. It concludes with a calendar showing the chief pests of stock that occur in each month, with suggestions for a programme of control, and a comprehensive index.

RAY (Harendra Nath). Tick Fever in domesticated Animals in India.—*Agric. Live-Stk India* **8** pt. 4 pp. 347–360, 1 pl. Delhi, July 1938.

Descriptions are given of the parasites that cause various forms of piroplasmosis in cattle, sheep, goats, horses and dogs, anaplasmosis in cattle, sheep and goats, and spirochaetosis in poultry, with notes on the symptoms and control of the diseases for which they are responsible. The identity of the ticks concerned in transmission is not definitely known, except in the case of piroplasms injurious to dogs [cf. *R.A.E.*, B **24** 189; **26** 57; etc.], and of *Spirochæta (Treponema) anserina*, the causal organism of spirochaetosis of poultry, which is transmitted by *Argas persicus*, Oken.

THEODOR (O.). On Sandflies (*Phlebotomus*) from Ceylon, Siam and Malay.—*Indian J. med. Res.* **26** no. 1 pp. 261–269, 4 pls., 14 refs. Calcutta, July 1938.

A collection of sandflies from Ceylon included examples of *Phlebotomus zeylanicus*, Annan., among which were discovered some of the

hitherto unknown females of *P. arboris*, Sinton [R.A.E., B 19 235]; adults of both sexes of these two species are described. Both sexes of *P. iyengari* var. *malayensis*, n., are described from Selangor, Malay Peninsula, and, from a comparison of the descriptions, *P. hivernus*, Raynal & Gaschen [23 272] is considered a variety of *P. iyengari*, Sinton [21 226]. A comparison of a female from Bangkok, Siam, with descriptions and illustrations of *P. barraudi*, Sinton, from India [17 112] and Indo-China [22 190] indicates that the forms from Siam and Indo-China may have to be made distinct varieties of this species. Two females of *P. bailyi* var. *campester*, Sinton, from Bangkok, differ somewhat from those described by Sinton [19 132] in the arrangement of the teeth in the buccal cavity. *P. stantoni*, Newst., *P. argentipes*, Ann. & Brunn., and *P. squamipleuris* var. *indicus*, Thdr., are recorded from Ceylon.

[**Symposium on the Malaria Problem in India.**]—*Proc. nat. Inst. Sci. India* 4 no. 2 pp. 119–251, 1 fldg map, 3 figs., many refs. Calcutta, June 1938.

In this report of a conference on various aspects of the malaria problem in India, which was held at Calcutta on 27th and 28th August 1937, summaries of all the papers presented and of the discussions of them are given in the course of the first few pages (pp. 119–143), followed by the text of most of the papers in full.

In Urban Malaria in the United Provinces (pp. 177–180), A. C. Banerjea outlines the principal factors responsible for the occurrence of malaria in the United Provinces, where it is chiefly endemic. The spring rise is due mainly to *Plasmodium vivax* and the autumn rise to *P. falciparum*. Of the mosquitos found, *Anopheles culicifacies*, Giles, and *A. stephensi*, List., are the two that have been frequently reported as transmitting the disease in urban areas.

In Topography of Land in relation to Malaria (pp. 181–184), M. O. T. Iyengar points out that in a country with different topographical regions, the Anopheline fauna varies considerably. Bengal may be divided into the regions of mountains, foot-hills, dry undulating plains, delta, and estuaries. In the mountain region, there is little malaria because there are no extensive breeding places for Anophelines, species capable of transmitting the disease are scarce, and climatic conditions, which are temperate, are unfavourable for its transmission. In the foot-hill region, streams are numerous during the wet season and form suitable breeding places for Anophelines, including species susceptible to malaria infection, and transmission is facilitated by the aggregations of labour in tea gardens and rice-fields. This region was at one time extensively covered with dense tropical rain forest, and it seems probable that with the clearing of the forests, the Anophelines that breed there and are not concerned in the transmission of malaria are replaced by vectors. In the pastoral region, rainfall is low and malaria occurs only in places where opportunities for Anopheline breeding have been increased by the impounding of water for irrigation, the subsidence of land in colliery districts, interference with natural drainage, etc. In the western section of the deltaic region, where the distributaries of the Ganges are silted up and embanked, malaria is highly endemic, whereas in the eastern section, which is subject to extensive flooding during the rainy season, it is practically absent. Malaria also occurs in areas where the subsoil water

is low. The estuarine region on the sea coast was at one time completely covered with dense mangrove forests and subject to flooding by the tides, and Anopheline breeding did not occur. In many places the forest has now been cleared and the islands embanked all round to prevent the access of the tides; this has resulted in intensive breeding of *Anopheles sundaicus*, Rdnw., and a high incidence of malaria. From this study it appears that the incidence of malaria in Bengal was low when the country was in its virgin state, and that its present high incidence in many places is largely due to the operations of man.

In Irrigation and Malaria (pp. 185-189, 2 refs.), W. C. Sweet describes the three systems of irrigation in Mysore. In the first, the water is supplied from small reservoirs depending on irregular rainfall and the area covered is small and seldom malarious. In the second, water is supplied from larger reservoirs that seldom go dry, and the area covered is more extensive and frequently malarious. In the third, the water is supplied by rivers, and the area covered is very extensive and invariably malarious. The systems appear to differ in the length of the main and subsidiary channels, the amount of water used, and the season of the year in which water is available. In all of them, efficient drainage is lacking. It is suggested that the regulation of the amount of water supplied and of its use offers the greatest hope of control.

In Antimalaria Operations in Delhi (pp. 201-202, 5 refs.), M. K. Afridi outlines the chief causes of the occurrence of malaria in Delhi and the control measures that have been carried out since 1936, when the Government of India initiated a comprehensive malaria control scheme based on such of the recommendations made after previous surveys [cf. R.A.E., B 23 19, etc.] as were considered valuable under existing conditions.

In Control of Anophelines Breeding in Irrigation Channels by Paris-green (pp. 203-209, 4 refs.), B. A. Rao reports on the control of *Anopheles culicifacies*, Giles, and *A. fluviatilis*, James, the two malaria vectors in the Negenhalli area of Mysore. Their breeding is practically confined to the channels irrigating the rice-fields that cover almost the whole area. The only other important source of *A. culicifacies* is the rice-fields themselves, but breeding in them is confined to a short period in June-July, a season when malaria transmission does not take place. Paris green has been used with success in this area since 1930 as a 1 per cent. mixture, with road dust and ash as the diluent [cf. 22 68]. It is shown that Paris green is almost ineffective against first- and second-instar larvae, but this does not prevent the satisfactory control of breeding, because the mixture is applied once a week (or oftener if necessary), so that the larvae that survive a first application are killed by a second before they pupate.

In Flood-flush Schemes in Bengal (pp. 215-218), T. A. Curry explains that "flood-flushing" is the controlled introduction of water on to land to improve the health of the population of the area flushed, as well as to fertilise the land and irrigate the crops, and can only be carried out in the flood season when the rivers are heavily charged with silt and full to overflowing. The only limits to the amount of water introduced are those imposed by the survival of crops, the capacity of the drainage systems and the safety of buildings, culverts, etc. The effect of embankments in Bengal has been to prevent the fertilisation of the soil and to raise the rivers above the level of the surrounding country, so that seepages form mosquito-breeding swamps.

The flood-flush schemes control breeding by flooding the breeding places and by introducing silt and larvical fish into channels, ditches and reservoirs. Examples of the satisfactory results obtained by the application of this method are given. It is now the policy of the Irrigation Department of Bengal to abolish embankments and to prohibit the erection of new ones.

In Surface and Subsoil Drainage (pp. 219-222), F. C. Griffin discusses the ways in which natural drainage may be obstructed so that mosquito breeding places are formed, and the means that may be taken to control breeding both on land where there is sufficient natural slope for drainage by gravity and in low-lying areas where it is necessary to use "flood-flush" schemes or to remove the water by pumping.

In Physical Factors in Mosquito Ecology (pp. 223-227, 29 refs.), R. Senior White reviews the literature on those chemical factors in water collections that may be correlated with mosquito breeding [cf. 25 69; etc.].

In *Anopheles iudlowii* (*A. sundaiicus*) Survey in and around Calcutta (pp. 229-235, 10 refs.), P. Sen gives the history of the gradual spread of *Anopheles sundaiicus*, Rdnw., into the City of Calcutta from the surrounding districts [cf. 25 234; 26 180; etc.].

In Natural Parasites of Mosquitoes in India (pp. 237-239, 15 refs.), M. O. T. Iyengar briefly summarises the records of parasites of mosquitos and concludes from their incidence and the morbidity caused to their hosts that only microsporidia, Mermithids and fungi of the genus *Coelomomyces* are of importance in India. Two species of *Coelomomyces* occur in India, *C. indiana* and *C. anophelesica*, both of which infest Anophelines in the larval and adult stages, causing considerable mortality. Several species of *Anopheles* are susceptible. The vegetative forms consist of multinucleated mycelia in the haemocoel of the mosquito and are attached to the fat-body by means of minute hyphae. Sporangia are formed by apical constriction of the mycelium. A heavily infested larva is filled with numerous yellowish sporangia. The infection is fatal, the larva generally being killed before pupation. The pathological changes consist in the disappearance of the fat-body and the suppression of the development of the imaginal buds. Three genera of microsporidia have been recorded by the author as infesting mosquito larvae in India, namely, *Thelohania* [cf. 18 134], *Plistophora* and *Nosema*. The last attacks the epithelial cells of the mid-gut and the other two the adipose tissue. In a heavily infected larva development is arrested, the larva dies and the spores are liberated into the water. Larvae are infected by swallowing the spores. The life-histories include a schizogonic and a sporogonic cycle. In *Nosema* the mother cell forms a single spore, in *Thelohania* an octospore and in *Plistophora* more than 16 spores. The spores are minute and dehisce by extrusion of a polar filament, a characteristic of this group. Information on the Mermithids has already been noticed [cf. 18 133].

In Observations on the Nutrition of *Panchax panchax* (Hamilton) (pp. 245-251, 4 refs), S. L. Hora and K. K. Nair give an account of experiments in the field and laboratory on the food of this top-minnow. They conclude that it is more effective in destroying mosquito larvae under Indian conditions than is *Gambusia* or *Lebistes*. The genus comprises small, carnivorous surface-feeding fish that are exceptionally hardy, since they have been found to tolerate very foul waters and to live in damp situations out of water for long periods. They are

reported to breed freely throughout the year in confined waters, to be difficult to catch and not to be valued as food. Thus they satisfy all the requirements laid down by malariologists for useful larvicultural fishes.

The papers of which only summaries are published include : Malaria and its Relation to Agriculture in India, by G. C. Chatterjee, in which he points out the beneficial effect on malaria control of a system of balanced agriculture, including the production of fodder crops for feeding cattle ; Malaria in Portuguese India, by F. de Mello [cf. 26 234] ; Irrigation and Malaria in the Madras Presidency, in which S. G. Masillamani discusses the types of irrigation used in Madras Presidency and their relation to the incidence of malaria ; Mosquito Control in Calcutta, in which K. L. Chowdhury deals in a general way with the measures taken for the control of malaria in particular areas in Calcutta and its environs ; Larvicidal Fish, in which G. C. Chatterjee gives an account of the larvivorous fish found in Bengal ; and another paper with the same title in which S. L. Hora urges the use of indigenous fish for the control of mosquito larvae.

STRICKLAND (C.). Malaria in Relation to the Coastal Lagoons of Bengal and Orissa.—*Indian med. Gaz.* 73 no. 7 pp. 399–402, 1 pl. 2 maps. Calcutta, July 1938.

The process of formation of lagoons at or near the sea-coast is described and illustrated by particular examples along the coast of Bengal and Orissa. In general, they are formed by the flood waters of rivers or the high tides of the sea, which leave a residuum of water behind a bank of silt deposited as they return to their normal levels. As more and more silt is deposited, the lagoons become shallower and are less often and less extensively inundated ; the water in them becomes increasingly less brackish and fresh-water plants gradually appear and cover the surface. By the deposition of silt, the accumulation of wind-borne material and the growth of plants, the banks may become high enough to prevent the further access of sea-water to the lagoon, but where the waters of rivers draining the hinterland pass through the lagoon, they make a breach in the bank through which the salt-water enters, except at times when the rivers are in flood.

In general, where the access of sea-water is prevented, *Anopheles sundanicus*, Rdnw. (*ludlowi*, auct.) does not breed in lagoons and malaria does not occur in their vicinity. It is suggested, in the case of Chilka Lake, that a partial closure of the existing outlet would raise the level of the water brought in by the rivers and so destroy the breeding places afforded by the shallow water on the foreshore ; the passage of the river waters through the lake at the time of the rains should not, however, be obstructed. Such breeding places might also be eliminated if the deposition of silt on the foreshore were encouraged by the planting of mangroves or "nal" reed [*Arundo karka*], both of which are of economic value, or by the erection of groynes.

ALI (P. Mohamed). A Rat-flea Survey of Mattanchery (Cochin) (1937).—*Indian med. Gaz.* 73 no. 7 pp. 409–412. Calcutta, July 1938.

The acquisition of information regarding plague infection in Mattanchery has recently become necessary in view of the occurrence

of sporadic outbreaks and the increasing importance of the adjacent port of Cochin with the consequent possibility of the reintroduction of infection from other ports. A rat-flea survey was, therefore, carried out in Mattanchery between 18th November and 18th December 1937. *Mus (Rattus) rattus* constituted 91.7 per cent. of the 291 rodents trapped, and most of them came from the residential rather than the warehouse area. Of 705 fleas, 480 were *Xenopsylla astia*, Roths., 179 *X. brasiliensis*, Baker, and 46 *X. cheopis*, Roths., of which 21 were obtained from the residential and 25 from the warehouse area. In a survey in 1930, none of the last-named species was found. The occurrence of plague in rats in Mattanchery has recently been demonstrated; 72 per cent. of the positive results were obtained with *M. (R.) norvegicus*. *X. cheopis* was found in comparatively large numbers on rats trapped in two houses where cases of plague in man had occurred. The comparative scarcity of *X. cheopis* may be one of the main reasons for the small number of cases in man. The fact that *M. norvegicus*, which seems to be the species of rat most susceptible to plague, does not associate with man so freely as *M. rattus*, is much less numerous and has the lowest *X. cheopis* index may also be of importance.

HODGKIN (E. P.). *Division of Entomology*.—*Rep. Inst. med. Res. F.M.S. 1937* pp. 71–86. Kuala Lumpur, 1938.

KINGSBURY (A. N.). *Annual Report of the Malaria Advisory Board (F.M.S.) for the Year 1937*.—Med. 8vo, 19 pp., 1 pl. Kuala Lumpur, 1938.

Investigations on Anophelines and the transmission of malaria on estates and in villages in Malaya were continued in 1937 [cf. *R.A.E.*, B 26 18]. From observations on one estate, the breeding places of *A. novumbrosus*, Strickl., and of the species commonly called *A. umbrosus*, Theo. [*loc. cit.*] are briefly discussed [cf. 26 230], together with their seasonal prevalence. Of 3,929 females of the latter and 752 of the former dissected since September 1936, 5 and 6, respectively, were infected in the salivary glands and 19 and 3 in the mid-gut only. Thus, although their relative prevalence is different, they are equally important as vectors of malaria. Trapping of Anophelines in one of the villages on the road from Klang to Kuala-Selangor was discontinued in February; from the two years' investigations, it was obvious that malaria was being transmitted by *A. barbirostris*, Wulp, *A. sundaeicus*, Rdnw., and the species called *A. umbrosus*. Of these, *A. barbirostris* was apparently the most important; only 15 females of this species out of 2,860 dissected during the two years were infected, but as this would represent an infected bite every second month, the rate is sufficient to account for the endemic malaria. A bund was erected round the second village in 1936 and 1937, and the trap was moved to the centre of the village, which, when the bund is working satisfactorily, will be half a mile or more from tidal influence. The contrast of the results with those of the previous year was striking; in none of the larval surveys did the number of breeding places of *A. sundaeicus* exceed seven, there was no great increase in breeding during the period July–October, although at that time there was a slight increase in the numbers of adults caught, and an average of only one example per night was trapped as compared with five. Although the bund and sluice gates were not completed until the end of 1937, salt water had been excluded to a large extent some months

earlier, and it is concluded that conditions unfavourable for *A. sundaeicus* had thus been produced. Since water collections of a salinity suitable for the breeding of this species were found throughout the year, the change in prevalence cannot be ascribed entirely to a reduction in salinity, and it seems possible that the prevention of repeated inundation with fresh supplies of salt water is of importance. Observations in the third village were continued. Tables giving the results for the two villages show the numbers of females caught, and the numbers infected, the numbers of breeding places found and of larvae taken, and the results of analyses of 213 samples of water from breeding places.

The study of the transmission of *Filaria (Microfilaria) malayi* in the Sabak Bernam Peninsula was continued [cf. 26 19] and investigations in other endemic areas were undertaken. On the lower reaches of the Perak and Pahang rivers, where filariasis is highly endemic, mosquitos of the genus *Mansonia* were present in enormous numbers, the two principal species being *M. uniformis*, Theo., and *M. longipalpis*, Wulp. Although the numbers so far dissected are not large, there is no doubt that these are the two chief local vectors. The larvae of *M. uniformis* have been found in association mainly with the water hyacinth (*Eichhornia crassipes*), but also with a number of other water plants. From the large numbers of *M. longipalpis* that are present at times in virgin swamp jungle, there can be no doubt that it breeds there, but the exact situations are unknown. It probably also breeds in the more overgrown parts of open swamps, and a few larvae associated with those of *M. uniformis* have been found among water hyacinths. Any attempt to control its breeding will be difficult and expensive: Owing to its great flight range, dwellings should be situated more than half a mile from its breeding places. In one village 500 or more examples of this species were caught nightly in one man-baited trap.

A survey at Sabak Bernam showed that the riverside villages were the most heavily infected and that the infection rate decreased as the coast was approached. The results of trapping and dissecting mosquitos in this area are shown in a table. Mosquitos of the genus *Mansonia* were nowhere so numerous as on the Perak and Pahang rivers. The infection rate in *M. longipalpis* and *M. uniformis* was about 1 per cent., but the results of dissections of *M. indiana* were negative. When females of *Mansonia* caught near Sabak Bernam were allowed to feed on an infected person, the majority of those of *M. annulifera*, Theo., *M. longipalpis* and *M. uniformis* became infected, but only one of the females of *M. indiana*, although examples of this species reared from larvae taken near Kuala Lumpur were found to be readily infected. *M. annulata*, Leic., the only other Malayan species of the subgenus *Mansonioides*, has also proved to be readily susceptible to infection.

Various species of mosquitos were fed on suitable carriers of *Filaria (Dirofilaria) immitis* and *F. (Wuchereria) bancrofti* to obtain material for comparison with the corresponding developmental stages of *F. malayi*, and the results are shown in a table. *F. immitis* is common in dogs in Malaya. In the Federated Malay States, filariasis due to *F. bancrofti* is mainly confined to immigrants from India and China, and its principal vector, *Culex fatigans*, Wied., although widely distributed, is not usually numerous. *F. immitis* developed readily in a number of different species, including several of *Mansonia*.

It was found that the mature larvae of the three species could be distinguished from one another. The larvae of *F. immitis* develop in the malpighian tubes and there is, therefore, no possibility of confusing the immature stages with those of the other two species, which develop in the thoracic muscles and between which no distinguishing features were found.

Experiments in which larvae of *A. vagus*, Dön., were exposed for 10 minutes to a 7 μ film of diesel oil no. 48 on water at temperatures of 70, 80 and 90°F. indicated that there is a simple relationship between temperature and the penetrating power of the oil, the death rate over the range of temperatures used increasing by about 1 per cent. for each degree of temperature. Although of little importance in the laboratory, temperature may be of some importance in the field. Further experiments [cf. 26 19] in which batches of 400 larvae were exposed for 5, 10, 20 and 40 minutes to films of a thickness of 1, 2, 3, 5 and 7 μ , showed that the death rate was proportionate to the thickness of the film and to the length of exposure. However, it was obvious that, even with an exposure of 40 minutes, a 1 μ film of this oil, which is only moderately active, has little effect.

Lists are given of the Anophelines caught in traps in Kuala Lumpur and in a locality in Lower Perak and collected from the Singapore and Penang mail trains, showing the numbers of males and females and the numbers dissected; the only infection was found in the mid-gut of a female from a train.

The second paper records the work accomplished and the information obtained during the year on various investigations connected with malaria and its control and with filariasis; much of the information of entomological interest is dealt with in greater detail in the first paper. The continued occurrence of cases of malaria in the vicinity of the town of Raub, despite the extension of anti-larval measures, led to an intensive investigation of streams in the neighbourhood. This showed that *Anopheles maculatus*, Theo., was breeding in two small areas well within the jungle at points where the vegetation was not sufficiently dense to prevent sunlight from reaching the numerous seepages. These seepages were more than half a mile from the place where cases had occurred.

ALVARADO (C. A.). **La lucha contra el paludismo en el país.** [Measures against Malaria in Argentina.]—*Bol. sanit. Dep. nac. Hig. Argent.* 2 no. 5 pp. 451-463. Buenos Aires, May 1938.

This is a survey of the special features of the problem of malaria and its control in Argentina. The disease occurs at the foot of the mountains, and sometimes among them, where there are no marshes, whereas it is absent in the marshy districts on the Pilcomayo river in Formosa, and on the Paraná river in Corrientes and the Chaco territory. All the Anophelines that are found in these marshy districts are zoophilous. On the other hand, *Anopheles pseudopunctipennis*, Theo., which attacks man readily and is the only proved vector of malaria in Argentina, occurs in the north. It is not the most abundant Anopheline there, but the other species are of no importance. For instance, the breeding places of *A. argyritarsis*, R.-D., are about twice as numerous as those of *A. pseudopunctipennis*, but only one individual of the former is found in dwellings for every 10,000 of the latter. In view of the success of drainage in Italy, this method was for

many years carried out in Argentina, but while of value agriculturally, it did not control malaria. In 1933 and 1934, the reason was found to be that the preferred breeding places of *A. pseudopunctipennis* are not marshes and bogs, but brooks and rivers that have sunny banks and in which an alga of the genus *Spirogyra* that affords essential food and shelter to the larvae is abundant. The latter occur also in drainage canals faced with stone or concrete, as the alga becomes established in them and the higher aquatic plants able to displace it cannot thrive. The number of breeding places has thus actually been increased by drainage.

Since the chief factor in the breeding of *A. pseudopunctipennis* is the presence of the alga, control measures should be directed to its elimination. This may be achieved by encouraging the growth in rivers of higher forms of aquatic and subaquatic vegetation, such as *Cardamina flaccida* and *Senecio cremeiplorum*, although these do not survive the summer floods, and by accelerating the reclamation of recently flooded areas along river banks by planting quick-growing trees to consolidate the soil, which will then support normal vegetation. Breeding places within 2½ miles of human habitations that cannot be treated in this way should be oiled, dusted with Paris green or cleared of the alga.

AYROZA GALVÃO (A. L.) & LANE (J.). *Notas sobre os Nyssorhynchus de S. Paulo. VI. Revalidação de Anopheles (Nyssorhynchus) oswaldoi Peryassú, 1922, e discussão sobre Anopheles (Nyssorhynchus) tarsimaculatus Goeldi, 1905.* [Revalidation of *A. oswaldoi*, Peryassú, and Discussion of *A. tarsimaculatus*, Goeldi.]—*Livro jub. Travassos* pp. 169–178, 2 pls., 15 refs. Rio de Janeiro, 1938.

The authors discuss the identity of the Anophelines recorded by various authors from Brazil as *Anopheles tarsimaculatus*, Goeldi. They conclude that the one studied by Townsend [R.A.E., B 21 149; 23 16] and eventually considered by him to be *tarsimaculatus* var. *oswaldoi*, Peryassú, is the true *tarsimaculatus*. They also consider that *A. oswaldoi* is a distinct species [cf. 26 18, 98], and that, in addition to the typical form, it is represented in Brazil by two varieties, which they describe from characters of the adults and eggs as var. *noroestensis*, n., and var. *metcalfi*, n., the latter being the form recorded as *A. tarsimaculatus* by Root [14 198]. They state that the eggs of the typical form are unknown.

DA COSTA LIMA (A.). *Entomologia médica. Nota sobre algumas espécies de Psorophora (Janthinosoma) (Diptera: Culicidae).* [Medical Entomology. Note on some Species of *Psorophora*.]—*Acta med.* 1938 no. 3 repr. 6 pp., 2 figs. Rio de Janeiro, 1938.

The author briefly discusses the classification of some species of *Psorophora*, notably *P. albipes*, Theo. This species is commonly considered to be a synonym of *P. lutzi*, Theo., but from examination of material from Matto Grosso, Brazil, in which both species were included, the author distinguishes them by the tarsal claws, which are blackish in *P. lutzi* and grey in *P. albipes*.

MACNAY (C. G.). **An effective Repellent for biting Insects.**—*Canad. Ent.* **70** no. 8 pp. 175–176. Orillia, Ont., August 1938.

As a result of two seasons' experiments in Canada, an effective repellent has been developed for personal application against mosquitos, Simuliids and other blood-sucking insects. It consists of $\frac{1}{2}$ fl. oz. oil of thyme, 1 fl. oz. concentrated extract of pyrethrum in mineral oil (containing the extract of approximately 0·2 lb. pyrethrum flowers), and 2–3 fl. oz. castor oil. It must be applied to cover exposed parts completely and affords protection for 3–5 hours.

BLACKLOCK (D. B.). **A Device for applying Oil or other Liquids to flushing Cisterns.**—*Ann. trop. Med. Parasit.* **32** no. 2 pp. 109–114, 3 figs. Liverpool, 2nd August 1938.

A description is given of an apparatus designed to prevent the breeding of mosquitos in the water of cisterns used in water-closets, etc., in the tropics, by the automatic application of oil to the surface of each lot of fresh water introduced, the device being operated by the movement of the lever arm when the chain is pulled.

STEPHANIDES (T.). **The Mosquitos of the Island of Corfu, Greece (Continued).**—*Bull. ent. Res.* **29** pt. 3 p. 251. London, October 1938.

A list is given of five species of mosquitos to be added to those previously recorded from Corfu [R.A.E., B **26** 28], with notes on their breeding places. The Anophelines are *Anopheles maculipennis*, Mg., race *sacharovi*, Favr (*elutus*, Edw.) and *A. plumbeus*, Steph.

QADRI (M. A. H.). **The Life-history and Growth of the Cockroach *Blatta orientalis*, Linn.**—*Bull. ent. Res.* **29** pt. 3 pp. 263–276, 7 figs., 33 refs. London, October 1938.

Observations on the development of *Blatta orientalis*, L., were carried out at 27·5°C. [81·5°F.]. The cockroaches were kept in glass dishes with a layer of sand at the bottom, fed on ground whole wheat and supplied with water.

The following is taken from the author's summary : The cockroach passes through one pronymphal and six nymphal instars. Descriptions are given of the post-embryonic growth (including the increase of the antennal and cercal joints and the modifications of the external genitalia), the formation and structure of the spermatophore, and the exact mode of copulation. It is shown that the instars and sexes of the nymphs can be distinguished. The average time required by 27 nymphs to reach maturity at 27·5°C. was 279 days ; the males both mature and die earlier than the females. The females deposited their oothecae in holes in the sand, dug with mandibles and forelegs, and subsequently covered them over.

BARDELLI (P.). **Note sulla Tularemia.** [Notes on Tularaemia.]—*Clin. vet.* **61** no. 6 pp. 306–318, 2 pls., 63 refs. Milan, June 1938.

The literature on tularaemia in various parts of the world is reviewed. In 1931 a centre of infection originating from hares imported into

Italy from Hungary was discovered in the province of Rovigo. The infection was stamped out, and all imported hares have been made subject to veterinary examination.

PETERS (G.). **Eine moderne Eisenbahn-Entwesungsanlage.** [A modern Railway Fumigation Plant.]—*Anz. Schädlingsk.* **14** pt. 8 pp. 98–99, 3 figs. Berlin, 15th August 1938.

A ferroconcrete tunnel, recently built in Budapest for fumigating railway waggons and passenger coaches, is the first large plant of its kind in which the mixture of hydrocyanic acid gas and air is circulated by a fan able to re-distribute it completely more than 30 times in an hour. Three parallel ducts of different lengths run side by side beneath the centre line of the roof and serve for extraction, while the supply under pressure is effected by a pipe with vents, which lies on the floor along one of the side walls. Sufficient gas for one fumigation is generated by two tins of Zyklon. These tins are loaded into a special apparatus housed outside the tunnel, and the dosage may be regulated as desired. The empty tins can be removed without danger to the operator.

GÖSSWALD (K.). **Ueber die hygienische Bedeutung der Ameisen.** [On the Importance of Ants in Relation to Health.]—*Z. hyg. Zool.* **30** nos. 7–8, 9 pp. 202–213, 264–269, 5 figs., 2 pp. refs. Berlin, 1938.

This is a survey of the literature on the importance of ants in the spread of pathogenic organisms, the effects of their bites and stings, the part they play in destroying other Arthropods of medical or veterinary importance, and the therapeutic value of formic acid.

ECKSTEIN (F.). **Die Mückenbekämpfung im Feld und in der Etappe.** [Mosquito Control in the Field and in the Bivouac during military Operations.]—*Z. hyg. Zool.* **30** pt. 7–8 pp. 213–227. Berlin, 1938.

Apart from the danger of malaria transmission by Anophelines, the efficiency of troops can be reduced as a result of attacks by large numbers of other mosquitos. This occurred notably among troops in Alsace during the Great War and necessitated a study of the various species. The work done is discussed, as the experience gained may be of value in the future. It was found that *Aedes* spp. are usually concerned, though *Mansonia* spp. and *Culex pipiens*, L., may occasionally prove very troublesome. In Alsace, where summer measures had to be taken against *Aedes vexans*, Mg., drainage and the spraying of pools and similar breeding places proved satisfactory.

BARANOV (N.). **Prilog poznavanju prirodnih neprijatelja golubačke mušice iz klase insekta.** [Contribution to the Knowledge of natural Enemies of the Golubatz Fly of the Class of Insects.]—*Arh. Minist. Poljoprivr.* **5** no. 11 repr. 12 pp., 44 refs. Belgrade, 1938. (With a Summary in German.)

Field observations on insects attacking the adults of *Danubio-similium columbacense*, Schönb., have been carried out in the village

of Golubatz on the Danube since 1934 [cf. R.A.E., B 22 204], the predators observed being the Empid, *Hilara maura*, F., the Asilid, *Dioclea longicornis*, Mg., the Anthomyiid, *Chiroisia crassiseta*, Stein, the Gyrinid, *Gyrinus natator*, L., and the waterbugs, *Hydrometra stagnorum*, L., *Gerris najas*, DeG., and *Velia rivulorum*, F. The morphological characters of each species and its genus are described and brief notes on its bionomics are given. The adults of *D. longicornis*, which appears to be the most important predator, rest on shrubs and grasses waiting to seize the passing Simuliids; they are not limited to the banks of streams, but occur everywhere in the presence of shrubs and woods, and it is estimated that they destroy ten times as many Simuliids as *H. maura* does. The males of the latter species catch the females of *D. columbacense* when they are close to the surface of the water and carry them to their own females. *C. crassiseta* is only abundant where *Pteridium aquilinum* is present, as the larvae live in the stems of the leaves of this fern; the adults seize the Simuliids on the banks of the streams as well as above the surface of the water [cf. 26 214]. The other four species are of little importance, as they prey on the flies only when they are above or on the water surface.

PAPERS NOTICED BY TITLE ONLY.

PARROT (L.) & WANSON (M.). *Phlébotomes du Congo belge. VIII. Sur le mâle de Phlebotomus gigas Parrot et Schwetz 1937.*—*Rev. Zool. Bot. afr.* 31 fasc. 1 pp. 153–156, 3 figs., 1 ref. Brussels, 1938.

PATTON (W. S.) & Ho (Ch'i). *The Study of the Male and Female Terminalia of the Genus Sarcophaga, with Illustrations of the Terminalia of the haemorrhoidalis Group.*—*Ann. trop. Med. Parasit.* 32 no. 2 pp. 141–157, 8 figs., 11 refs. Liverpool, 2nd August 1938.

Ho (Ch'i). *On some Species of Sarcophaga from Java and its neighbouring Islands.*—*Ann. trop. Med. Parasit.* 32 no. 2 pp. 115–127, 12 figs., 6 refs. Liverpool, 2nd August 1938.

SINTON (J. A.), HUTTON (E. L.) & SHUTE (P. G.). *Failure to transmit an Infection of Plasmodium cynomolgi to Man by Blood Inoculation and by Mosquito Bites* [using *Anopheles maculipennis*, Mg., race *atroparvus*, van Thiel].—*J. trop. Med. Hyg.* 41 no. 15 pp. 245–246, 16 refs. London, 1st August 1938.

MARNEFFE (H.). *Notes sur le paludisme à Java.*—*Rev. Méd. Hyg. trop.* 30 no. 4 pp. 185–206, 9 figs. Paris, 1938. [See R.A.E., B 26 161.]

TRAGER (W.). *Multiplication of the Virus of Equine Encephalomyelitis in surviving Mosquito Tissues [in vitro].*—*Amer. J. trop. Med.* 18 no. 4 pp. 387–393, 14 refs. Baltimore, Md., July 1938.

OBITZ (K.). *Biologia, rozpowszechnienie i zwalczanie gza bydlęcego (*Hypoderma* spp.). (Streszczenie).* [The Biology, Distribution and Control of the Cattle Grub (*Hypoderma* spp.). (Summary).]—*Roczn. Ochr. Rośl.* 5 no. 3 pp. 15–16. Warsaw, 1938. [Cf. R.A.E., B 23 170; 25 200; 26 61.]

WOODBURY (E. N.). **Test Methods on Roaches. German Cockroach as a test Insect for Liquid Petroleum Insecticides . . . a Report of Ohio State Fellowship Investigations.**—*Soap* 14 no. 8 pp. 86-90, 107, 109, 6 figs., 1 ref. New York, N.Y., August 1938.

Since no investigations on the testing of liquid household insecticides against crawling insects, such as cockroaches, have been carried out that are comparable with those using the Peet-Grady method against house-flies [*Musca domestica*, L.], it has been necessary to assume that satisfactory fly sprays are effective against crawling insects and that the relative effectiveness of fly sprays containing different substances is the same for both these classes of insects. The possibility that these assumptions might be incorrect led to the investigations described in which a method was evolved for testing kerosene-base insecticides in the form of a settling mist against the German cockroach (*Blatella germanica*, L.).

In order that a continuous supply of cockroaches of known age should be available, it was necessary to evolve a method of rearing large numbers, and this is described in some detail. The stock cage is 4 feet square with sides $5\frac{1}{2}$ inches high and is open at the top except for 3-inch strips of celluloid, which form a horizontal flange overhanging the interior of the cage. Cockroaches cannot climb greased surfaces, and their escape is prevented by coating the interior surfaces of sides and flanges with a thin film of vaseline. Pieces of pleated waxed paper and strips of corrugated cardboard laid on the bottom of the cage provide shelter, and water is supplied automatically by inverting a jar of water in a dish. Food, which is placed in Petri dishes, consists of a mixture of 50, 45 and 5 parts by weight of ground whole wheat, dried skim milk powder and baker's yeast moistened until it forms a crumbly mass and then allowed to dry. The only care required, other than cleaning and the supply of food, is the occasional renewal of the vaseline film. Small cylindrical cardboard containers are used for rearing cockroaches hatching from a single egg capsule. The containers are dipped in melted paraffin wax to render them more resistant to moisture. The cardboard disk in the lid is replaced by a perforated disk of transparent celluloid. The female cockroaches are introduced and withdrawn, and food is inserted, through a hole 15 mm. in diameter cut near the bottom and closed with a cork. Water is supplied by means of a small piece of glass tubing (containing a wick of cellucotton) inserted in the bottom with its lower end immersed in water contained in a galvanised iron trough 4 feet long, $2\frac{1}{2}$ inches wide and 1 inch deep, on which about 13 cages rest. The troughs stand on sliding shelves placed above one another beneath the table bearing the stock cage. In this way 1,235 small cages were maintained in a space of 85 cu. ft.

Female cockroaches bearing well-developed egg capsules were taken from the stock cage and placed singly with a little food in the small cages. The cages were examined daily and when newly emerged nymphs were observed, the date was noted and the females returned to the stock cage. An average of 30 nymphs hatched from a single capsule and, with little further attention, became adults in 60-70 days at a room temperature of about 85°F. Used cages were washed with mild soap and warm water and the wicks were renewed before another female was introduced.

Spraying was carried out by means of an artists' air brush with a detachable metal cup of 5 cc. capacity; it was mounted at the top of a celluloid cylinder 40 inches high and 8 inches in diameter standing on a celluloid slide covering a recess in a wooden base made to hold a small circular cage containing the test insects. In each test about 30-40 young nymphs in a test cage were placed beneath the celluloid slide and 4 cc. of the insecticide was pipetted into the metal cup and sprayed into the cylinder during a period of 30 seconds. After an interval of 20 seconds to allow air currents within the cylinder to subside, the slide was withdrawn and the cockroaches exposed to a settling mist for the desired length of time. They were then removed to a rearing cage and counts of the dead and moribund were made at the end of 24 hours.

The following is taken from the author's summary : Pyrethrum-oil sprays of different concentrations have a different effect on the house-fly and the German cockroach ; most flies have died or recovered completely in 24 hours, whereas many cockroaches are in a moribund condition at the end of the same period. Since the percentage of cockroaches dead in 24 hours was not proportional to the pyrethrin content of the spray, whereas the percentage of dead and moribund together was, the moribund cockroaches were considered dead when determining percentage mortality. On the basis of concentration by weight of the toxic principle required to kill a given percentage of second instar nymphs, rotenone and pyrethrins were about equally toxic, whereas normal butyl carbitol thiocyanate was much less toxic but possessed striking paralytic properties. There was no difficulty, however, in increasing the amount of the thiocyanate until a high kill was obtained. A spray containing equal quantities of rotenone and pyrethrins was not more toxic to second-instar nymphs than an equivalent quantity of either alone. Adult males were about $2\frac{1}{2}$ and females about $4\frac{1}{2}$ times as resistant to the Official Test Insecticide as second-instar nymphs. Pyrethrum sprays caused females to drop their egg capsules and some of these subsequently gave rise to nymphs ; normal butyl carbitol thiocyanate produced the same effect to a lesser degree ; rotenone had no effect in this respect.

The investigation showed that it is possible to make quantitative comparative tests of kerosene-base insecticides against *B. germanica*, but since the rearing of cockroaches takes more time and labour than the rearing of houseflies, it is not considered advisable to use them for routine tests. Moreover, this would not be necessary if a correlation could be established between the results of Peet-Grady tests on houseflies and those on cockroaches by testing the same samples of several types of kerosene-base insecticides against both species. It is possible that the usual fly-sprays are not the most efficient liquid insecticides for the control of cockroaches. Since the adult female and the nearly mature unhatched eggs within the capsule appear to be the most resistant stages, any investigations on the value of new formulae should include tests on these stages.

CORSON (J. F.). A fourth Note on the Infectivity to Man of a Strain of *Trypanosoma rhodesiense*.—*J. trop. Med. Hyg.* 41 no. 16 pp. 262-265, 9 refs. London, 15th August 1938.

Further experiments were carried out on the infectivity to man of the strain of *Trypanosoma rhodesiense* isolated in 1934 and maintained

in sheep and antelopes by cyclical transmission through *Glossina morsitans*, Westw. [cf. R.A.E., B 26 156]. In the first series, flies that had transmitted the strain maintained in sheep only to a further sheep (21st successive passage by *G. morsitans*) were fed separately on rats and two of nine found to be infected were each allowed to bite one of two native volunteers, both of whom contracted sleeping sickness. In the second series, five infected flies isolated from a batch fed on a dikdik infected by the fly that had failed to infect the European volunteer [*loc. cit.*] transmitted the disease to eight out of ten native volunteers on whom they fed singly. In the third series, five and one infected flies isolated from two batches fed, respectively, on two sheep each infected by one of the two flies that had previously failed to infect two native volunteers [*loc. cit.*], transmitted the disease to five out of 11 and two out of four native volunteers on whom they fed singly. An apparent difference in the infectivity to man of two flies that had fed at the same time on an infected sheep was shown by the fact that one of them failed to infect a native volunteer who was infected 11 days later by the other. It is concluded that the infectivity of the strain has not been lost. The author points out that although the infectivity of particular strains maintained in the laboratory may be lost or retained, this would not prove that strains in nature would behave in the same manner. Nor would a temporary loss of infectivity to man, even if it could be proved, show that *T. rhodesiense* had changed into *T. brucei*, although the acquisition of infectivity to man by a strain of *T. brucei* from Zululand would be strong, though not conclusive, evidence of the identity of the two species.

NASH (T. A. M.). **Comments on a recent Paper by Dr. C. H. N. Jackson on the Study of *Glossina morsitans*.**—*Proc. zool. Soc. (A)* 108 pp. 79-84. London, 1938.

In this paper, the author comments on certain aspects of Jackson's investigations on *Glossina morsitans*, Westw., at Kakoma, Tanganyika Territory [R.A.E., B 25 162] and replies to Jackson's criticisms of his own work at Kikori [cf. 21 197; etc.].

In his conclusions, he concedes that Jackson's research into true density could not have been carried out without disturbing natural conditions, and that since the disturbances affected equally the methods employed for ascertaining both true and apparent density figures, the results are comparable. Moreover, the extent of the disturbance was not so great as to obliterate the general trend of the natural fly-density cycle for the year, since this agrees in the main with that found by himself over a period of many years. On the other hand, the investigation was very short and was carried out under conditions that were rendered so complex by the presence and introduction of various factors (disturbance in the very small area investigated of the fly population by marking and re-marking, movements of game, etc.) that it was impossible to isolate the climatic factor and consequently to discern a correlation between the size of the population and the evaporation rate [cf. 21 197]. Thus the author considers invalid the assertion that his results regarding the "optimum zone" are not of universal application [25 163], particularly since these results have been confirmed by his more recent investigations in Northern Nigeria [cf. 25 160], where climatic conditions are far hotter and drier than in Tanganyika Territory.

JACK (R. W.). Annual Report of the Division of Entomology for the Year ended 31st December, 1937.—*Rhod. agric. J.* 35 no. 8 pp. 652-676; also as *Bull. Minist. Agric. [S. Rhodesia]* no. 1080, 25 pp. Salisbury, August 1938.

In the course of the medical and veterinary section of this report (pp. 659-671), J. K. Chorley gives an account of the situations in 1937 in the various localities in Southern Rhodesia in which control measures against *Glossina morsitans*, Westw., were or had been carried out [*cf. R.A.E.*, B 25 280]. The history of controlled game destruction and the creation of fly-free buffer zones as a measure for checking the advance of the fly is very briefly reviewed, and it is pointed out that this measure has now passed the experimental stage and can with confidence be applied to any area on the periphery of a fly-belt, wherever land is required for development. The immediate objects of the present policy in the various districts is outlined, but it is also suggested that the fly might be eradicated from all the infested areas in the Colony by judicious and cautious extension of controlled game destruction over a period of years, and that this could be combined with the establishment of game sanctuaries in the areas cleared of fly, so that no extermination of species of game animals would take place. In areas in the low veldt where elephant and rhinoceros are abundant, other measures, such as bush and thicket clearing, might have to be employed; rhinoceros cannot be driven, are very localised and remain for years in the vicinity of a few favourite water-holes. The area to which these measures might be applied lies outside the zone of European settlement and little mining activity is likely to develop. During the year, a further area of 1,500 square miles was reclaimed.

A number of cases of trypanosomiasis of cattle occurred during the year on farms adjacent to the Melsetter border [*cf. 24* 201; *25* 281]. As most of these farms were in the basins of the Inyamadzi or Chiredza rivers or were connected by a forest belt with them, further clearing was undertaken at the junction of these two rivers where they cross the border, the clearing being made approximately three-quarters of a mile wider at this point. The original clearing was maintained, all re-growth being slashed back, and grass-burning was successfully carried out in October. A further spread of *G. morsitans* in Portuguese East Africa towards the border was recorded, flies being taken at a point not more than five miles from the border clearing, so that the threat of invasion at the southern end of the Melsetter district has increased.

Amblyomma hebraeum, Koch, has extended its range northward from Matabeleland to the Gwelo and Hartley district [*cf. 24* 201].

POULTON (W. F.) *Glossina Investigation and Reclamation*.—*Rep. vet. Dep. Uganda 1937* pp. 8-9. Entebbe, 1938.

In this section of his report, which includes a brief account of the clearing work carried out against *Glossina morsitans*, Westw., in various parts of south Ankole in 1937, the author states that, in general, there is a reduction in the prevalence of the fly throughout this region [*cf. R.A.E.*, B 25 51], particularly in one area where six collectors took only 35 males and 2 females in more than a month in sections where four years previously hundreds of flies could be taken without difficulty in one day.

ONO (S.). **Studies on Warble-flies of Manchuria and Inner Mongolia.**—
Kitasato Arch. **15** no. 3 pp. 199–246, 8 pls., 3 diagr., 11 refs.
 Tokyo, July 1938.

A detailed account is given of investigations on the morphology and bionomics of the warble-flies, *Hypoderma lineatum*, Vill., and *H. bovis*, DeG., based chiefly on observations made on pastures in Inner Mongolia and on examinations of cattle at the abattoir at Mukden, southern Manchuria. *H. lineatum* is the most prevalent species in both districts. Adults are present from the middle of May to early June, or a little later in more northerly regions. After this, first-instar larvae can be found in the submucous connective tissues of the oesophagus and in the connective tissue and serous membrane of various organs in the body cavity until, in the middle of January, they reach the back, perforate the skin, and moult to the second instar. The larvae continue to live in the warbles under the skin until they reach the fifth instar [cf. *R.A.E.*, B **22** 8] and then, about the middle of March, they emerge, fall to the ground and pupate. Descriptions are given of the adults of both sexes of both species, and of the egg and the five larval instars based chiefly on *H. lineatum*. The site of oviposition is discussed; the dewlap was most frequently selected [cf. **23** 105]. In no case was oviposition on the lower part of the leg observed in either district; this is probably because, at the season when the adults are active, grasses grow vigorously by the side of ponds or rivers where the fly is abundant and the legs of the cattle are consequently wet. The distribution of young larvae in two calves at the end of May is described [**23** 105]. During 5 years (from 1930 to 1934), 10,914 head of cattle were examined with regard to infestation of the oesophagus. Infestation begins in the middle of May, and the percentage of cattle infested increases gradually until the maximum is reached in November or December, and decreases suddenly during January. At the beginning of the infestation, the average number of maggots in the oesophagus is small (4–6); it rises to about 30 in September–November and declines in December, until toward the end of January no larvae are present. The body length of the maggots varied from 1·6–3·0 mm. in May to 10·0–17·0 mm. in December. Emergence of the larva from the warble is described; a larva that emerged about 9 a.m. on 16th May had pupated by evening. The length of the pupal stage under dry conditions averaged 22 days at 12°C. [53·6°F.] and 10 at 28–30°C. [82·4–86°F.]; under moist conditions at 18°C. [64·4°F.], it was 31–40 days.

When larvae 5–6 mm. in length removed from the oesophagus of slaughtered cattle were transplanted to the subcutaneous tissue of the lateral concave portion of the loin, many migrated to the abdominal cavity and some to the thoracic cavity, but none was found in the submucous membrane of the oesophagus. When, however, similar larvae were transplanted under the skin of the dewlap, most of them migrated to the submucous membrane of the oesophagus, and some seemed to be on their way there, since they were found in the serous membrane surrounding the oesophagus. Similar results were obtained when larvae were transplanted under the skin of different parts of sheep, most of those from the loin entering the abdominal cavity and most of those from the dewlap and neck the submucous membrane of the oesophagus. Larvae in the process of migrating to the skin

of the back were observed in sheep; some were at the juncture of the diaphragm with the oesophagus, others in the intercostal muscles and the muscles of the loin and the back; no larvae were ever observed in the spinal canal. Observations on the relation between larval development and change in the tissue of the host skin were made in naturally infested cattle. The larvae of the first instar perforate the skin, but the warble is not formed and no putrefaction takes place until the third instar is reached [cf. 22 8]. Observations and experiments on the nature and reactions of the hypodermatotoxin [22 8] are described.

In addition to cattle, horses are naturally infested with *Hypoderma* in Mongolia.

MURRAY (C. A.). **A statistical Analysis of Fly Mortality Data.**—*Soap*
13 no. 8 pp. 88-99, 101, 103, 105, 9 refs. New York, N.Y.,
 August 1937.

In view of discrepancies in the results obtained in testing insecticides on flies [*Musca domestica*, L.] by the official Peet-Grady method [cf. R.A.E., B 26 244], experiments were carried out using samples of an insecticide having the same toxic value, and the results were subjected to statistical analyses with the object of discovering the factors responsible for the variability and evolving a more dependable procedure.

A progressive increase in the rate of mortality in successive tests on batches of flies from the same cage tested on the same day was found to be at least partly due to an accumulation of the insecticide on the floor of the Peet-Grady chamber [cf. 16 255], in spite of the fact that the floor, ceiling and walls were wiped with a cloth between each test. This factor was practically eliminated by covering the floor with fresh paper for each alternate test (a clean side being used for each test); a statistical examination of the results indicated, however, the persistence of some influence causing more than expected differences. Since differences in the average mortalities of flies from different cages continued to occur, further experiments were made to determine whether they were due to differences in the susceptibilities of the sexes, to inadequate mixing of the flies that emerged from different batches of pupae into the cages, to an increase in susceptibility of flies in a cage due to their not being fed during the $2\frac{3}{4}$ hours occupied by the experiment, or to the fact that flies knocked down in the first few minutes and lying on the floor in different positions received the downward drifting insecticide unevenly for the remainder of the 10-minute exposure period. With a view to examining these factors, the conditions of the experiments were altered. Fresh paper was again used on the floor. The sexes of the flies were determined when the counting was carried out, so that the percentage mortality of males and females separately could be calculated. The method of obtaining flies for the cages was changed so that a better mixing of the emerging flies was obtained. Food was supplied in all but two cages during the hours of testing, and the period of exposure was reduced from ten minutes to four, while, to compensate for a possible consequent decrease in kill, the dosage of insecticide was increased from 12 ml. to 15. The far greater susceptibility of the males was clearly demonstrated. Higher percentages of flies were killed in the first six tests than in the last six tests using flies from the same

cage, and this appears to be related to the relatively higher susceptibility of the males, since this sex usually predominated in the earlier tests. These results also indicate that this method of testing has eliminated whatever factors caused the increasing mortalities in successive tests observed in the previous experiments. Apparently, unfed flies are more susceptible than those fully nourished, since the average percentage mortality in flies from the two cages in which no food was supplied was higher in the afternoon than in the morning, whereas in flies from the other cages the average mortalities in the morning and afternoon were similar. It is suggested that this digestive factor was probably associated with the accumulation of toxic material on the floor of the chamber in the production of the increasing mortalities in successive tests noted in the first series of experiments. The similarity of the average percentage mortalities of a given sex for two cages tested on the same day indicate that with a proper rearing technique (including the random selection of flies by mixing pupae from different rearing cans), batches of flies may be obtained that are uniform for one test day. Since, however, the average mortalities for the different days were irregular, it is concluded that maintenance conditions have an influence on the susceptibility of the flies.

Experimental procedure for carrying out tests by this method when samples of different insecticides are to be compared is described. This procedure has been used with success to test and evaluate different samples.

SIMANTON (W. A.). Evaluating Liquid Insecticides. Comments on the 1937 Official Method and use of the Official Control Insecticide in grading Liquid Household Sprays.—*Soap* 13 no. 10 pp. 103, 105, 107, 115. New York, N.Y., October 1937.

In the two years following the adoption in 1932 of the Peet-Grady test as the official method for testing liquid household insecticides, it was found that although a given laboratory could usually reproduce its evaluation of an insecticide with fair accuracy, evaluations of the same insecticide by different laboratories were so variable as to be of little value. This led to the adoption in 1936 of a specified pyrethrum solution as a standard for comparative tests (Official Control Insecticide), but its use was limited by the lack of a method for expressing the comparative mortality data obtained. Analysis of data from tests by co-operating laboratories led to the conclusion that the degree of difference between the average kill figures obtained for two insecticides could be used as a means of evaluating products, provided that all replications in a series gave reasonable similarity in results. In 1937 a uniform method of reporting Peet-Grady test results for samples used in conjunction with the Official Control Insecticide (O.C.I.) was adopted, and this is given in full, with explanatory notes. The tests must be conducted according to the current Peet-Grady test procedure. The chamber must be wiped out after each test with a cloth saturated with carbon tetrachloride, and, if paper is used on the floor, it must be changed after each group of 2-3 tests. The average mortality for the O.C.I. must be between 30 and 70 per cent., and if possible between 50 and 60 per cent., and the dosage of this and of the sample should be altered if necessary to accomplish this. Not more than two unknown

insecticides may be tested in conjunction with the O.C.I. in any one series and not less than 10 tests of the O.C.I. and of each of the unknowns must be made in parallel, *i.e.*, each sample of the series must be tested the same number of times with flies of the same batch on any one day, the order of testing to be systematically varied. Enough tests must be made for the standard error of the mean difference between the average mortalities for the O.C.I. and the unknown sample to be less than three. The samples must be graded according to the mean differences between the mortalities obtained with them and with the O.C.I. and designated AA, A, B, C, and D, when the differences are, respectively, +21 or higher, +11 to +20, between +10 and -10, -11 to -20, and -21 or lower. If it is necessary to supply a numerical value for the unknown sample, the difference between it and the O.C.I. should be added to 60 and ± 3 written after the result. The data obtained when co-operating laboratories tested an unknown insecticide using this procedure are shown in a table. There are still a number of discrepancies in the results, but since the figures for each laboratory are significant, it seems obvious that there were factors in each laboratory causing flies to react differently, in addition to those eliminated by the use of O.C.I. It is pointed out that more information on the bionomics of the flies is needed before the accuracy of the tests can be improved [cf. 26 244].

SULLIVAN (W. N.), HALLER (H. L.), McGOVAN (E. R.) & PHILLIPS (G. L.). **Knockdown in Fly Sprays. Comparison of Toxicities of Pyrethrins I & II as determined by Method for Knockdown and Mortality.**—*Soap* 14 no. 9 pp. 101, 103, 105, 1 fig., 9 refs. New York, N.Y., September 1938.

The apparatus used in the turntable method of testing the toxicity of fly-sprays [cf. *R.A.E.*, B 26 246] was modified so that the "knock-down" or number of flies that had fallen to the ground at different intervals during the course of the 10-minute exposure period could be ascertained by photographs. The removable aluminium covers of the large cylinders were replaced by glass ones and the aluminium disks resting on the flange at the bottom of the cage-holders (small cylinders) beneath the screened Petri dishes in which the flies are held were removed. A camera was focussed on the bottom of the cage containing the flies to be photographed, and a 15-inch reflector containing a 40-watt electric light bulb was centred three inches above the top of the large cylinder containing the spray mist. The light entering from above was diffused by the droplets of spray so that it formed a good background for taking silhouette pictures of the paralysed flies. All flies except those on the bottom of the Petri dish were out of the narrow range of the sharp focus used. The sprayed flies on the bottom of the cage that had not been knocked down by the spray seldom remained motionless during the entire one-second exposure, and any movement caused a blurred image that could readily be recognised when counts were made from the negative or from an enlargement of it. Approximately 15 minutes were required to spray and photograph a series of five tests.

This apparatus was used to compare the toxicities of three sprays in the first of which Pyrethrin I predominated, in the second, Pyrethrin II and in the third, the two substances were present in approximately equal proportions. In the first series of tests, the total

pyrethrin content of the three sprays was 3 mg. per cc. and in the second series, 0.25 mg. Ten lots, each consisting of 100 examples of *Musca domestica*, L., were exposed for 10 minutes. The mortality was estimated after the flies had been in recovery cages for 24 hours. In the first series, the first spray caused a mortality about twice as high as that caused by the second and the third gave intermediate results; after 30 seconds' exposure the second spray had paralysed about 4½ times as many flies as the first. In the second series, the mortality was below 20 per cent. for all sprays and failed to show marked superiority for any mixture, but the second spray had knocked down about 11 times as many flies as the first after three minutes' exposure and about 3½ times as many after 10 minutes' exposure. The differences between mortalities and "knockdowns" are statistically significant as measured by the standard error of the mean.

BURDETTE (R. C.). Some of the Principles governing the Production of air-floated Oil Particles and their Relation to the Toxicity of Contact Oil Sprays to Insects.—*Bull. N. J. agric. Exp. Sta.* no. 632, 31 pp., 9 graphs., 4 refs. New Brunswick, N.J., January 1938.

Air-floated contact oil sprays are being used in greater quantities from year to year for the control of certain household insects and insects troublesome to domestic animals. The term "air-float" is given to a spray that has been dispersed as a very fine mist in the air. The experiments described were designed to reveal the nature of this air-float and to determine how the most efficient spray of this character could be produced. A light oil of definite specification was used and toxicity tests were carried out against honey-bees.

The following is taken from the author's conclusions: A little less than half of the total oil delivered was in droplets of ultra-microscopic sizes and possibly partly gas, and a little more than half in droplets of 1 micron or more in diameter. In still air all droplets greater than 10 microns in diameter settle out of the air suspension in about four minutes. The toxicity of the fog or air-float to bees lies mostly in the portion consisting of droplets ranging from 1 to 10 microns. The structure of the air-float is the result of the interaction of the flow of air and liquid, which in turn depends on pressure and on the size of the orifice from which the spray is projected. The structure can be varied at will by the proper manipulation of these physical factors. To obtain a maximum kill, sufficient material of the optimum structure (1-10 microns) must be atomised to produce a concentration of 0.03 cc. per cu. ft. air. Increasing temperatures between 50 and 90°F. were accompanied by increased mortality. Variation of relative humidities from 29 to 90 per cent. had little, if any, effect on the percentage mortality.

ESCOMEL (E.). La maladie de Carrion ou verruga du Pérou. Les dernières acquisitions.—*Bull. Soc. Path. exot.* 31 no. 7 pp. 536-554, 5 figs. Paris, 1938.

This review of knowledge of verruga contains a short section on its transmission [*cf. R.A.E.*, B 26 60, etc.], in which it is stated that a volunteer bitten by *Phlebotomus* contracted the eruptive form of the disease, thus proving that sandflies are the vectors.

COLAS-BELCOUR (J.) & NICOLLE (P.). *Sur le parasitisme du cobaye par un mallophage sud-américain, Trimenopon jenningsi K. et P.* Présence de sang et de rickettsies dans le tube digestif de l'insecte.—*Bull. Soc. Path. exot.* **31** no. 7 pp. 635-640, 1 pl., 21 refs. Paris, 1938.

Trimenopon jenningsi, Kellogg & Paine, was found in large numbers on experimental guineapigs in France during the first months of the year. This is a South American species first described from wild guineapigs. The egg and nymph are described. Although Mallophaga are reputed to feed on such material as the débris of feathers and fur, more than 50 per cent. of the individuals on some guineapigs contained freshly ingested blood. Examination of smears of the digestive tracts of the lice also revealed rickettsiae, which were particularly numerous in the presence of blood.

MATHIS (M.). *Influence de la nutrition larvaire sur la fécondité du stégomyia (Aëdes aegypti).*—*Bull. Soc. Path. exot.* **31** no. 7 pp. 640-646, 9 refs. Paris, 1938.

The author states that differences in the biological reactions (fecundity, aggressiveness, resistance to cold, heat and desiccation, etc.) of *Aëdes aegypti*, L., cannot be explained unless all stages of its development from egg to egg are taken into account. The first experiment described shows that the numbers of blood meals taken and the numbers of batches of eggs and the total numbers of eggs deposited by two females reared at Dakar under the same conditions were similar. The larvae from which they were derived completed their development in 6 days at a temperature of 28-30°C. [82.4-86°F.], which is the temperature of the laboratory in July; this rapid development invalidates the present measures for the destruction of larvae, which are undertaken during house to house examinations at weekly intervals. The three other experiments described, in which strains of the species from various countries were used, show that females derived from larvae fed on a rich or abundant diet laid more eggs than those from larvae fed on a poor diet or from larvae collected in nature and reared in their natural medium. The low fertility and short life frequently observed among mosquitos caught in nature are probably due to the deficiency of larval nourishment during the cool, dry season. On the other hand, females are found during the warm, rainy season, the size and fertility of which equal, but do not exceed, those of females reared in the laboratory.

EKBLOM (T.). *Les races suédoises de l'Anopheles maculipennis et leur rôle épidémiologique. (Deuxième communication.)*—*Bull. Soc. Path. exot.* **31** no. 7 pp. 647-655, 3 figs., 7 refs. Paris, 1938.

An account is given of further investigations on the distribution of the races of *Anopheles maculipennis*, Mg., in Sweden [cf. R.A.E., B **23** 179]. The race previously recorded as *labranchiae*, Flni., is now considered to be *atroparvus*, van Thiel. It was not found possible to establish any correlation between the transmission of malaria in Sweden during the previous century and any particular race of *A. maculipennis*.

NERI (F.) & GRATCH (I.). **Distribuzione delle razze anofeliniche nelle zone malariche della provincia di Ravenna.** [The Distribution of Anopheline Races in the Malaria Zones of the Province of Ravenna.]—*Riv. Malariol.* **17** pt. 4 pp. 242–261, 1 map, 2 graphs, 24 refs. Rome, 1938. (With Summaries in English and German.)

A study of the characters of the eggs laid by Anophelines caught in a number of stations in 1937 was made to ascertain the distribution in the plains round the city of Ravenna of the various races of *Anopheles maculipennis*, Mg. *A. hyrcanus* var. *pseudopictus*, Grassi, also occurred in a few localities. Of the females that oviposited, 2,253 (56.3 per cent.) were *A. maculipennis* race *messeae*, Flni., 764 (19.09) race *sacharovi*, Favr (*elutus*, Edw.), 658 (16.44) race *atroparvus*, van Thiel, 118 (2.95) race *maculipennis* (*typicus*), 14 (0.35) race *labranchiae*, Flni., and 195 (4.8) *A. hyrcanus* var. *pseudopictus*. Malaria is of slight importance in this region, but benign tertian [*Plasmodium vivax*] is endemic in localities where *messeae* predominated. The character of the disease is even more mild in places where *atroparvus* was also found. The zones in which *sacharovi* occurred were formerly subject to fairly intense malaria, but are now characterised either by complete freedom from the disease or by slight epidemics or rare sporadic cases of benign tertian. The surface water in them is brackish.

MÜNCHBERG (P.). **Dritter Beitrag über die an Stechmücken schmarotzenden Arrenurus-Larven (Ordn.: Hydracarina).** [Third Contribution on Larvae of *Arrenurus* parasitising Mosquitos.]—*Arch. Hydrobiol.* **33** pt. 1 pp. 99–116, 8 figs., 13 refs. Stuttgart, 1938.

The following is based on the author's summary of this paper on water-mites of the genus *Arrenurus* that parasitise mosquitos [cf. *R.A.E.*, B **26** 15]. It is shown that mosquitos are parasitised by the larvae of 16 species of *Arrenurus*. *Anopheles maculipennis*, Mg., was the species most commonly infested in Germany, while species of *Theobaldia* and *Aëdes* were not attacked, except in very rare cases. The mosquitos became infested in the larval stage by the larvae of the mites, which suck the body juices and swell to 16 times their original size. Mosquitos may be infested by several species of *Arrenurus* at the same time. A description is given of the process of development in *Arrenurus fimbriatus*, Koen.; it lasted 2–3 days.

SWELLENGREBEL (N. H.) & DE BUCK (A.). **Malaria in the Netherlands.** —Demy 8vo, viii+267 pp., 2 pls., 23 figs., many refs. Amsterdam, Scheltema & Holkema Ltd.; London, Baillière, Tindall & Cox, 1938. Price 10s. 6d.

In this book a comprehensive account is given of all aspects of the problem of malaria and its control in Holland, based on observations and experiments carried out almost continuously since 1920. The results of those parts of the investigation that are of entomological interest have been noticed from time to time as they were published. The authors consider that the work has a more than local interest, since it constitutes a study of the epidemiology of the disease in a country where this is simplified by the presence of only one parasite of any importance (*Plasmodium vivax*), and of only one vector (*Anopheles maculipennis*, Mg., race *atroparvus*, van Thiel).

STRICKLAND (C.). Holland and Bengal. Reclamation and Malaria in the two Countries.—*Trans. R. Soc. trop. med. Hyg.* **32** no. 2 pp. 277-286, 1 pl., 13 figs., 7 refs. London, 25th August 1938.

In the first part of this paper, the author briefly discusses the reclamation of land in relation to the transmission of malaria in Holland by *Anopheles maculipennis*, Mg., and the probable effect on the incidence of the disease of the construction of the dam across the Zuyder Zee and the formation of new polders behind it [cf. *R.A.E.*, B **22** 36; **24** 282]. He then proceeds to describe the situation in the delta area of Bengal, where the small islets cut off by the net-work of waterways become partly surrounded by embankments as a result of the natural deposition of silt left by receding flood waters, and reclamation has generally consisted in completing and raising the embankments and sometimes also in damming up and draining small sections of the surrounding rivers. He discusses the effect of this reclamation on the incidence of malaria, and concludes that there is no reasonable basis for the statement that the generally high endemic malaria rate of the country is due to the obstruction in various ways of its natural flooding and flushing by the rivers [cf. **27** 6, 7], since the most closely embanked areas are the healthiest. If flooding and flushing is of no importance from the point of view of malaria in the delta regions, it may also be of no importance in the hinterland, and the high incidence of malaria there may be due to the dying rivers themselves, or the pools that mark their course, rather than to the prevention of their flooding. There is some indication that the Anopheline fauna of the two regions is different, and that malaria vectors that are common in the hinterland are rare in the Sunderbans.

GALLIARD (H.). Evolution complète de *Filaria bancrofti* chez *Aëdes (Stegomyia) aegypti*.—*C. R. Soc. Biol.* **128** no. 23 pp. 1111-1112. Paris, 1938.

A number of attempts have been made in Indo-China to infect *Aëdes aegypti*, L., and *A. albopictus*, Skuse, by feeding them on six persons infected with *Filaria bancrofti* and two infected with *F. malayi*, but in most cases subsequent dissection failed to reveal developmental forms of either parasite. Both species were, however, easily infected on one patient infected with *F. bancrofti*, partial development occurred in a number of females, and filarial larvae were found in the thorax, the head and the labium of one of *A. aegypti*. Only two other authors have obtained complete development of *F. bancrofti* in this species [*R.A.E.*, B **17** 192; **20** 282]. The author considers that in his experiments infection depended essentially on the person infected with the parasites. It is suggested that the results could be explained by presupposing the existence of different biological races of the parasite in the same locality.

[**Mosquito Control Work in 1937.**]—*Proc. N. J. Mosq. Ext. Ass.* **25** 232+3 pp., 10 pls., text-ill., many refs. New Brunswick, N.J., 1938.

In addition to reports on local mosquito situations and control work in Connecticut, Massachusetts, Rhode Island, New York,

Pennsylvania, Delaware, New Jersey, Oregon and Washington, the following papers are included: Summary of Mosquito Control Work in New Jersey in 1937, by T. D. Mulhern (pp. 11-47); Review of Advances in practical Methods of Mosquito Control, by F. A. Reiley & R. L. Vannote (pp. 79-84); Review of Advances in scientific Mosquito Knowledge, by J. G. Lipman (pp. 84-88); Review of economic Results of Mosquito Control; Work accomplished; Benefits derived from the Mosquito Association, by T. J. Headlee (pp. 88-100); Mosquito Control as related to Marsh Conservation, by J. L. Clarke (pp. 139-146), in which it is suggested that the control of mosquitos breeding in intermittent marshes might be brought about by constructing a deep central pool, connected by small channels to the shallow pools all over the marsh, to which the natural enemies of mosquito larvae could retreat when the rest of the marsh dries up and from which they would be re-distributed by the flood waters; Economic Importance of Malaria Control, by L. L. Williams, jr. (pp. 148-151); A Review of Mosquito Work throughout the World in 1937, by F. C. Bishopp & J. L. Webb (pp. 152-176); Mosquito Suppression Work in Canada in 1937, by A. Gibson (pp. 176-185); Factors affecting the Vegetative Cover of Delaware Marshes, by F. C. Daigh, D. MacCreary & L. A. Stearns (pp. 209-215); The Coordination of Mosquito Control with Wildlife Conservation, by C. Cottam (pp. 217-223); and Heartworm in Dogs, a Mosquito-borne Menace in New Jersey, by T. C. Nelson & M. L. Morris (pp. 227-232), in which the recent spread of *Filaria (Dirofilaria) immitis* in New Jersey is indicated.

The following is based on P. Granett's summary and conclusions of his paper entitled Comparison of Mosquito Repellency Tests under Laboratory and Field Conditions (pp. 51-57): For comparing results obtained with mosquito repellents against laboratory-reared females of *Aëdes aegypti*, L., with results obtained against other species of *Aëdes* under field conditions, bites per minute on untreated areas of the body is used as an index of the complex and variable factors influencing biting, and time elapsing until the first bite on the corresponding treated areas (protection time) is used as an index of repellency. Under the conditions employed, the caged mosquitos are shown to be more easily repelled than are the field mosquitos. The results indicate that the better repellents will be approximately 70 per cent., and the poorer ones (those that protect for less than half an hour) approximately 25 per cent., as effective out of doors as in the cage. The laboratory cage method of testing mosquito repellents thus offers a valuable aid to this type of investigation, since it makes available a means for the rapid elimination of poorer repellents and for the comparative evaluation of the better ones, and enables the work to be carried on throughout the year. The better ones can then be finally evaluated in the field under a variety of conditions.

Symposium on Malaria.—*Sth. med. J.* **31** nos. 7-8 pp. 797-819, 933-949. Birmingham, Ala., July-August 1938.

This series of papers read before the National Malaria Committee (Conference on Malaria), meeting conjointly with the Southern Medical Association from 30th November to 3rd December 1937, includes a number of entomological interest. In Historical Developments and

Progress in our Knowledge of Malaria Control (pp. 797-802), W. V. King briefly outlines the subject from the time of the introduction of cinchona bark into Europe about 1640 to the organisation of "malaria control units" as administrative divisions in the boards of health of the southern United States in 1937. In Recent Developments in Methods of Mosquito Control in Anti-malaria Campaigns (pp. 805-807, 38 refs.), by E. H. Hinman, and Recent Advances in the Epidemiology of Malaria (pp. 938-941, 29 refs.), by R. B. Watson, E. C. Faust and J. S. Simmons, the authors review from the literature some of the more interesting work that has been carried out during the last two years. In The Occurrence of *Anopheles walkeri*, Theobald in Georgia (p. 797), R. E. Bellamy and J. Andrews give notes on the breeding places in which larvae of the southern form of *Anopheles walkeri*, Theo. [cf. *R.A.E.*, B 25 27] were found in a locality in Georgia in the autumn of 1937, and point out that the females, which readily bit man, also resembled those of the southern form from Florida. In *A. albimanus* Breeding in Relation to Degree of Shade in Breeding Places (pp. 803-805), H. P. Carr describes experiments in Cuba, which show that larvae of *Anopheles albimanus*, Wied., disappear from water that is heavily shaded, not only because the consequent disappearance of vegetation exposes them to the attacks of *Gambusia*, but also in the absence of this fish, probably because shade inhibits the growth of the microscopic organisms on which the larvae feed. Shading is being used in Cuba as an anti-malarial measure to control the breeding of this species in streams where the activity of *Gambusia* is hampered by the prolific growth of *Spirogyra*. A good type of shade tree should be cheap and easy to secure in large numbers, it should be a hardy evergreen of rapid growth, and the wood, foliage and fruit should be of no economic value. In climates where frost does not occur, *Ficus benjamina* fulfills these requirements. Small trees can easily be obtained from the limbs of older ones by making a circular cut through the bark into the cambium layer and fastening a few pounds of fertilised earth round the cut by means of a piece of sacking. After about six weeks, roots grow from the cut into the earth, and the limb may then be removed from the tree and planted. Bamboo is also being used as a shade plant, but since the canes are useful to a limited extent, some may be removed by the public. In Further Observations on Airplane Dusting for *Anopheles* Larvae Control (pp. 808-813, 4 figs., 5 refs.), by C. C. Kiker, C. D. Fairer and P. N. Flanary, a rather more detailed account is given of the work carried out in connection with the application of Paris green by aeroplane to the Wheeler Reservoir for the control of breeding of *Anopheles* [*quadrimaculatus*, Say] during 1937 [cf. 26 132]. In Different Phases of permanent Drainage for Malaria Control in Mississippi (pp. 813-815, 3 figs.), N. H. Rector discusses briefly the filling of ponds, the lining of ditches with concrete, and the drainage of marshy areas by means of underground tile or by "French drains," which are constructed of poles set in broken rock or similar material. Round-bottomed inverts proved the most satisfactory for lining the bottom of ditches, and Bermuda turf [*Cynodon dactylon*] the most practical means of protecting the sloping sides. The construction of permanently lined ditches, which was begun in May 1936, has met with general approval; they eliminate mosquito breeding places for long periods, reduce the cost of control by means of larvicides, and enhance the value of adjacent property.

KNOWLTON (G. F.), HARMSTON (F. C.) & HARDY (D. E.). Blood-sucking Utah Diptera.—*Proc. Utah Acad. Sci.* 15 pp. 103–105. Provo, Utah, 1938.

Since mosquitos have been found to be capable of transmitting equine encephalomyelitis from diseased to healthy animals under experimental conditions [R.A.E., B 25 6] and since outbreaks of the disease have occurred in Utah in 1933–35 and 1937, it has been thought desirable to obtain information on the species and seasonal prevalence of blood-sucking insects. For this reason, a list is given of mosquitos and other blood-sucking Diptera taken in all parts of the state during the last few years, showing the localities and dates of collection.

Destruction of Mosquitos in Aeroplanes. A Test Flight.—*Lancet* 234 p. 1414. London, 18th June 1938.

According to the regulations of the International Convention for Aerial Navigation, the responsibility for ensuring the elimination from aeroplanes of insects that might carry tropical diseases devolves on the sanitary authorities of the various countries in which the aeroplanes land. There are obvious objections to this arrangement, since the measures and the thoroughness with which they are applied vary from place to place. For this reason, the Imperial Airways Company has been experimenting during the past two years to evolve a method of applying an insecticide that could be carried out by the crew of an aeroplane as soon as it leaves an infected airport. A brief account is given of a demonstration of such a method to a number of authorities. A flight was made in an aeroplane in which a number of boxes of mosquitos had been distributed. The proprietary insecticide used was an aqueous-base extract of pyrethrum, which has the advantage over the kerosene-base insecticides previously used [cf. R.A.E., B 25 253] that it is non-inflammable. The results were satisfactory, since only one or two of the 600 mosquitos remained alive until the following morning, the rest having died within 15 minutes. The observers were satisfied with the method, provided that one or two minor improvements were carried out, and the Company hopes that local governments will delegate to it the authority with which they were invested by the Convention.

WILSON (D. B.). Report of the Malaria Unit, Moshi, 1936.—Fol., 34 pp., 6 pls., 9 refs. Dar-es-Salaam, 1938.

An account is given of investigations carried out from the end of 1935 to December 1936 on the problem of malaria control in Tanganyika Territory, particularly in communities in the Northern Province that are only partly immune, and of the conclusions reached as a result of this and of previous work in other parts of the country [R.A.E., B 24 192]. The previous work, which was carried out chiefly in a group of hyperendemic villages and an urban area on the coast, is briefly summarised, and the methods used for making spleen and blood-film examinations, dissecting Anophelines, and identifying larvae are described. The question of immunity is discussed on the basis of observations made in various localities, and it is concluded that Africans who are not born in hyperendemic areas are unlikely to acquire an effective immunity if they move to an uncontrolled malarious locality, and that too little distinction is made between

individuals who are susceptible to malaria and those who are protected from it as a result of past infections. Africans who live in hyper-endemic areas do not appear to suffer ill effects from malaria in adult life, whereas those who are non-immune or who are exposed only to infrequent or seasonal re-infection (sub-immune) certainly do. This distinction must be taken into account in estimating the importance of malaria in any given community and, consequently, the economic practicability of undertaking measures of control.

Details are given of malaria and its control in Moshi and Arusha and on various estates, together with brief notes on further work that has been carried out in some of the localities dealt with in the previous report. The Anophelines encountered, in addition to the species mentioned in the previous report [*loc. cit.*], were *Anopheles garnhami*, Edw., *A. nili*, Theo., *A. pretoriensis*, Theo., *A. pharoensis*, Theo., *A. leesonii*, Evans, and *A. rivulorum*, Leeson, of which the first three were never taken in houses. *A. pharoensis* was repeatedly caught in very small numbers in houses in one locality, but the results of dissections of the salivary glands of 27 females were negative. Though they are members of the group of *A. funestus*, Giles, the practical importance of the finding of *A. leesonii* and *A. rivulorum* does not seem to be great. They were breeding in the same channel as *A. funestus*, and measures taken against the latter control them also. A re-examination of material taken in previous years on the coast showed that it consisted entirely of the last-named species.

The considerable variation in the relative numbers of *A. funestus* and *A. gambiae*, Giles, observed in one locality was dependent on the condition of vegetation in the irrigation channels, the former predominating when they were more overgrown and the latter when they were less so. The mean sporozoite rates for the year in different localities varied from 1·4 to 2·3 per cent., and are thus much lower than those found in localities on the coast [cf. 24 193]. It is believed that the most important factor concerned in producing this result is the action of a low humidity in shortening the life of the adult mosquito. To determine whether the presence of different biological races could be responsible, an attempt was made to correlate the wing length of *A. gambiae* with infectivity and season, but examination of more than 1,000 specimens revealed no significant difference in infectivity in examples with longer or shorter wings. It was, however, observed that the proportion of long-winged individuals increased after a rise in atmospheric humidity, and that, in the three localities from which the specimens were obtained, the higher the rate of infectivity the greater the proportion of long-winged specimens. It is concluded that the increased wing-length is the result of more favourable conditions, particularly higher humidity, and that in this respect it is correlated with infectivity. The results of mosquito catches and dissections in one locality show that infectivity is independent of the number of Anophelines present, for in this locality, where breeding depends on irrigation, there is no great seasonal variation in prevalence but the rate of infectivity is considerably higher at the time of the rains.

In the course of his general conclusions and recommendations, the author points out that the only available method of malaria control is that aimed at controlling Anophelines, and in most places this is usually far too expensive. He considers that the circumstance determining the need for control is the aggregation of any considerable

number of non-immune persons in a sufficiently endemic locality. Thus, control would appear to be justified in townships, in undertakings of a temporary character (such as the construction of railways) where different strains of *Plasmodium* and kinds of people are collected together, on estates where non-immune labour is employed or where endemicity is so high as to cripple the work of the directing staff, at places where non-immune communities are being established in endemic areas, and on railways for the protection of passengers. In the last case, it is suggested that the railway coaches should have double doors and the compartments should be mosquito-proofed, and that mosquito control measures should be carried out at the principal stopping places, particularly those where passengers are forced to wait overnight for trains.

COLLIGNON (E.). Observations sur les gîtes à larves d'anophèles en Algérie (1937) (département d'Alger).—*Arch. Inst. Pasteur Algérie* **16** no. 2 pp. 157–160, 1 map. Algiers, 1938.

This account of the breeding places of the Anophelines found in the Department of Algiers in 1937 is similar in form to that for the previous year [cf. *R.A.E.*, B **25** 278], but includes, in addition to the species there mentioned, *Anopheles marteri*, Sen. & Prun., larvae of which were found in a seepage pool at the foot of a rock.

AMBIALET (R.). Sur un essai de destruction de gîtes à larves d'anophèles par la méthode de Williamson (herbage cover).—*Arch. Inst. Pasteur Algérie* **16** no. 2 pp. 161–165, 1 pl. Algiers, 1938.

An account is given of an attempt to control the breeding of *Anopheles maculipennis*, Mg., in a stream near a village in the Department of Constantine, Algeria, during the summer of 1937, by the method of "herbage cover" [cf. *R.A.E.*, B **25** 46, etc.]. The attempt was only partly successful because the period during which Anopheline breeding ceased coincided with the period of putrefaction of the vegetation, which lasted for less than two months and was accompanied by an enormous increase in the breeding of Culicines and a disagreeable smell. After this time, the tangle of ligneous material remaining assisted in the aeration of the water by obstructing its flow and prevented the deposition of organic material by man and animals, so that conditions were favourable for the breeding of Anophelines, which thenceforward replaced the Culicines. In the untreated part of the stream Anophelines bred for a short period (less than two months), after which the general drought conditions brought about a decrease in the inflow of fresh water to the pools in the stream bed and a diminution in the amount of dissolved oxygen through the increasing amount of decaying organic material deposited by man and domestic animals that were forced to seek water at the stream when other sources dried up. The experiment indicates that this method, which can best be applied to permanent streams with a regular flow, is not suitable for wide application in Algeria, where such streams are rare.

COLLIGNON (E.). Une grande mesure antilarvaire : L'asséchement du lac Halloula.—*Arch. Inst. Pasteur Algérie* **16** no. 2 pp. 166–175, 2 pls., 1 map, 1 chart. Algiers, 1938.

This history of the incidence of malaria and of Anopheline breeding places in the region of the small village of Montebello, Department of Algiers, before, during and after the draining of the neighbouring swamp, indicates the very satisfactory results of this measure. It has reduced the size of the breeding places and the time during which they are present and has made them easily accessible so that larvicides may be applied early, whereas the principal breeding places had previously remained inaccessible for the greater part of the malaria transmission season. As a consequence, the spleen rate has decreased from a maximum of 71 per cent. just before the completion of the work in 1935 to 7 per cent. in the autumn of 1937.

SENEVET (G.). Les moustiques de la Guadeloupe (Mission 1936).—*Arch. Inst. Pasteur Algérie* **16** no. 2 pp. 176–190, 5 figs., 6 refs. Algiers, 1938.

An account is given of the ten species of mosquitos taken in the course of a visit to Guadeloupe during 1936, with brief notes on their breeding places. They included two new species of *Culex*, which are described, and three species of *Anopheles*, namely, *A. albimanus*, Wied., the presence of which in the lesser Antilles has previously been disputed, *A. argyritarsis*, R.-D., which was found only on Basse-Terre, unassociated with the other species, in minute collections of water full of vegetation and floating débris, and *A. tarsimaculatus*, Goeldi, which occurs in a form difficult to distinguish from *A. albimanus*. Characters of the males and larvae of *A. tarsimaculatus* are described, and the pupae of the forms of this species from Guadeloupe, Martinique and Guiana are compared with those of *A. albimanus*.

PARROT (L.). Notes sur les phlébotomes. XXVII. Phlébotomes d'Ethiopie.—*Arch. Inst. Pasteur Algérie* **16** no. 2 pp. 213–218, 3 figs., 6 refs. Algiers, 1938.

MARTIN (R.). Observations sur les phlébotomes d'Ethiopie.—*T.c.* pp. 219–225, 12 refs.

The results of an examination of a second collection of sandflies (*Phlebotomus*), made at Diré Dawa, Abyssinia, in 1936 and 1937, are given in the first paper. The species comprise six of those previously recorded [R.A.E., B **24** 160], *Phlebotomus squamipleurus*, Newst., which has not previously been taken in Abyssinia, and *P. wurtzi*, sp. n., and *P. notatus*, sp. n., of which the former is described from both sexes and the latter from the female only.

In the second paper, the 13 species or varieties that have been collected are discussed. *P. schwetzi* var. *aethiopicus*, Parr. (178 examples) and *A. langeroni* var. *orientalis*, Parr. (90 examples) are far the most numerous, and together constitute about 85 per cent. of the two collections. Sandflies appear in March shortly after the onset of the short rains, and reach their maximum numbers in April, May and June, when they are very abundant and aggressive. They are rather less numerous during the long rains, become progressively fewer during the last half of October and are very rare from November onwards. *P. langeroni* var. *orientalis* and *P. martini*, Parr., have been

taken in the act of biting man, and it appears probable that *P. papatasii* var. *bergeroti*, Parr., *P. schwetzi* var. *aethiopicus* and *P. viduus*, Parr., also attack man. The relation of sandflies to disease is briefly discussed, and it is pointed out that although visceral and cutaneous leishmaniasis have not been observed in Diré Dawa, there exists a disease that resembles sandfly fever, and *P. papatasii* var. *bergeroti* may be concerned in its transmission.

SENEVET (G.). Quelques Ixodidés de la Guadeloupe.—*Arch. Inst. Pasteur Algérie* **16** no. 2 p. 226. Algiers, 1938.

Ticks recently collected in Guadeloupe comprised *Amblyomma variegatum*, F., and *Boophilus annulatus microplus*, Can. (*australis*, Fuller) on cattle, and *Rhipicephalus sanguineus*, Latr.

DIAS (E.) & MARTINS (A. M.). Aspectos do typho exanthematico em Minas Geraes. [Exanthematic Typhus in Minas Geraes.]—*Brasil-Medico* **51** no. 14 pp. 431-441, 1 chart, 7 refs. Rio de Janeiro, 3rd April 1937.

An account is given of investigations on the exanthematic typhus of Minas Geraes [cf. *R.A.E.*, B **23** 148] at the town of Sabará, a focus of the disease. From its clinical aspects and the results of tests of the Weil-Felix reaction, it is considered to be closely allied to the exanthematic typhus of São Paulo, both being possibly identical with Rocky Mountain spotted fever [cf. **23** 149].

The authors collected possible Arthropod vectors and attempted to demonstrate the infection in them by inoculating suspensions of them into guineapigs. No infection was demonstrated in this way in a number of adults and nymphs of *Cimex lectularius*, L., or in *Rhipicephalus sanguineus*, Latr., *Ctenocephalides (Ctenocephalus) felis*, Bch., or *Xenopsylla cheopis*, Roths., all from infected houses, but inoculation of suspensions of 5 examples of *C. lectularius* and of 2 of *Amblyomma cayennense*, F., taken in one infected hut both gave positive results, although an adult and a nymph of *A. cayennense* had previously shown no infection.

At Pitangui, also in Minas Geraes, intraperitoneal injection of a suspension of an example of *A. cayennense* from an infected dog produced the infection in a guineapig.

A test in which individuals of *Panstrongylus megistus*, Burm., were allowed to feed on an infected guineapig and suspensions of their digestive tracts inoculated 2-9 and 23 days later into healthy animals gave negative results, showing that the virus was not conserved for as long as two days in the Triatomids.

In view of the fact that it is rare for more than one case of infection to occur in a house, the authors consider that the more usual vector is *A. cayennense*, but that infection within a house is transmitted by *C. lectularius*.

MOREIRA (J. A.) & DE MAGALHÃES (O.). Typho exanthematico de Minas Geraes.—*Brasil-Medico* **51** no. 21 pp. 583-584. Rio de Janeiro, 22nd May 1937.

The authors summarise the general conclusions that they have reached as a result of a study of the exanthematic typhus of Minas

Geraes, the details of which are to be published elsewhere. They regard it as a variety of Rocky Mountain spotted fever and suggest the name of exanthematic typhus of Brazil for it and the form known as exanthematic typhus of São Paulo. It is transmitted by *Cimex lectularius*, L., but *Amblyomma cayennense*, F., is the chief vector. Other indigenous ticks, such as *A. brasiliense*, Aragão, are probable vectors, and *Rhipicephalus sanguineus*, Latr., which is common in Minas Geraes, may be an accidental one, in view of the rôle of the dog in the cycle of the disease. The animals hitherto found infected in nature are an opossum (*Didelphys marsupialis*), the domestic dog, a wild dog (*Canis brasiliensis*), a rabbit (*Sylvilagus minensis*), *Cavia aperea*, and, possibly, an agouti (*Dasyprocta azarae*).

DIAS (E.), MARTINS (A. V.) & RIBEIRO (D. J.). **Typho exanthematico no oeste de Minas Geraes.** [Exanthematic Typhus in the West of Minas Geraes.]—*Brasil-Medico* **51** no. 24 pp. 651–655. Rio de Janeiro, 12th June 1937. (With a Summary in English.)

In 1934–36, cases of a disease thought to be exanthematic typhus occurred at Pitangui in western Minas Geraes, chiefly in the cold, dry months favourable to ticks. With one exception, they occurred singly in farms a mile or more apart, which can only be explained on the hypothesis of a rural vector. *Amblyomma cayennense*, F., was common, and one example, taken from a dog, produced the infection when a suspension of it was inoculated into a guineapig. In one house, two cases occurred; this may have been due to transmission by *Cimex lectularius*, L., which was numerous in it.

DIAS (E.). **Depositarios naturae e transmissores da febre maculosa brasileira.** [Natural Hosts and Vectors of Brazilian Exanthematic Typhus (Brazilian Spotted Fever).]—*Brasil-Medico* **52** no. 11 pp. 269–272, 26 refs. Rio de Janeiro, 12th March 1938.

From a review of the literature, the author concludes that Brazilian exanthematic typhus is transmitted by Ixodid ticks, which acquire it from animals, man being negligible as a source of infection.

The dog is probably the chief domestic reservoir, and *Amblyomma cayennense*, F., is the most important vector for man. Both *A. cayennense* and *A. striatum*, Koch, have been found naturally infected. *Rhipicephalus sanguineus*, Latr., may be important in maintaining the infection in dogs and may accidentally infect man. Ticks of the genera *Ixodes* and *Haemaphysalis* probably spread the infection among the wild animals that are its natural hosts.

SERGENT (A.). **Fièvre récurrente à Spirochaeta hispanicum en Algérie. Transmission par le rhipicéphale du chien. Prémunition. Sérum de convalescents.**—*Ann. Inst. Pasteur* **61** no. 3 pp. 217–254, 14 diagrs., refs. Paris, September 1938.

In the course of this paper on relapsing fever due to *Spirochaeta hispanica* in Algeria, the author gives an account of observations and experiments on its transmission by *Rhipicephalus sanguineus*, Latr., that have already been noticed from other sources [cf. *R.A.E.*, B **21** 230, 245; **24** 46].

TONNOIR (A. L.). On the Taxonomy of *Helicobia australis* (Sarcophaginae), a Dipterous Insect associated with Grasshoppers.—

Proc. Linn. Soc. N.S.W. **63** pt. 3-4 pp. 129-132, 2 figs., 8 refs.
Sydney, 15th September 1938.

FULLER (M. E.). On the Biology and early Stages of *Helicobia australis* (Sarcophaginae), a Dipterous Insect associated with Grasshoppers.—*T.c.* pp. 133-138, 5 figs., 4 refs.

In the first paper, descriptions are given of both sexes of *Helicobia australis*, Johnst. & Tiegs; that of the male is based on type material, but the female, one of a series bred in cages containing grasshoppers from the neighbourhood of Canberra, is described for the first time. In the second paper, larvae of the first, second and third instars and the puparium are described and compared with those of *Sarcophaga*. Details are given of experiments in which the females preferred decomposed to fresh meat for larviposition, and meat or a newly killed mouse to dead grasshoppers, while they did not deposit larvae on live grasshoppers [cf. *R.A.E.*, A **26** 629]. Larvae did not survive when placed on live grasshoppers, but some survived on dead ones. They were successfully reared on meat for several generations. When newly deposited larvae were placed on a sheep, they became full-fed in 49 hours, by which time they had produced a brown irritated patch on the skin, though they were scattered in the wool round it. They were removed and allowed to pupate, and all gave rise to adults.

WOODHILL (A. R.). Salinity Tolerance and pH Range of *Culex fatigans* Wied., with Notes on the Anal Papillae of Salt-water Mosquitoes.—*Proc. Linn. Soc. N.S.W.* **63** pt. 3-4 pp. 273-281, 1 fig., 8 refs. Sydney, 15th September 1938.

The following is taken largely from the author's summary: The statement recently made by Wanson & Nicolay that *Culex fatigans*, Wied., in the Belgian Congo develops normally in water containing 30 gm. chloride per litre [*R.A.E.*, B **25** 213] was not confirmed by experiments with the same species in Australia. Larvae in the first or fourth instar, when transferred from tap water direct to diluted sea-water, did not develop normally in concentrations greater than 10 gm. salts per litre and did not reach the pupal stage in water containing 13 gm. When the salinity of the water was gradually raised from 9 to 11-16 gm. during the development of the larvae from the first to the fourth instar, a few adults were obtained from water containing 14 gm. but not even pupae from that containing 16 gm. Larvae did not develop in water containing 10 gm. NaCl per litre with no other salts present [cf. **25** 94]. Pupae were not affected by salinity and developed into adults in water containing 105 gm. salts per litre. Variation of the pH of the water from 6.8 to either 4.2 or 9.0 slightly retarded the development of the larvae to the adult stage, but had no effect on the total number of adults produced. Changes in the walls of the anal papillae, similar to those described by Wigglesworth in *Aëdes aegypti*, L. [**21** 74], were observed at salinities of 11 to 15 gm., with considerable individual variation. When third-instar larvae were transferred from a salinity of 10 gm. to one of 13.5, the anal papillae were frequently destroyed, and when the larvae were returned to a salinity of 10, development to the adult

stage took place without them. In the larvae of species of mosquito that commonly breed in salt or brackish water in Australia and New Zealand, the anal papillae are reduced or absent. The structures in *A. concolor*, Taylor, previously referred to as rudimentary anal papillae [25 94], are considered to be homologous with internal rectal papillae.

KEMPER (H.). **Hausschädlinge als Bewohner von Vogelnestern.** [House Pests as Inhabitants of Birds' Nests.]—*Z. hyg. Zool.* **30** pts. 7-8, 9, 10 pp. 227-236, 269-274, 291-297, 1 fig., 2 pp. refs. Berlin, 1938.

The author gives lists of the numerous Arthropods found in birds' nests, based on investigations by himself in Germany and records from various countries in the literature. From the data obtained and a discussion of the literature on the subject, he concludes that birds' nests are of little or no importance as sources of infestation by pests troublesome in houses.

CAMERON (D.). **The Northern Fowl Mite (*Liponyssus sylviarum* C. & F., 1877). Investigations at Macdonald College, Que., with a Summary of Previous Work.**—*Canad. J. Res. (D)* **16** no. 8 pp. 230-254, 1 fig., 59 refs. Ottawa, August 1938.

An account is given of the synonymy, geographical distribution, morphology, bionomics, economic significance and control of *Liponyssus sylviarum*, C. & F., based on the literature and on the author's own observations made at Quebec between 1935 and 1937. In Europe and north America this mite has been found on 22 species of birds; it also attacks man and rats, but since it has not been observed to reproduce on them they are considered to be accidental hosts. In experiments carried out by the author in a dark incubator at a temperature of 100-104°F., mites in tubes in which the relative humidity was kept at 90-100 per cent. congregated at certain points in the tube and laid their eggs in clumps. No female was observed to lay more than one egg in captivity, and as females could not be fed and recovered, the number of eggs laid by each one could not be determined. The average durations of the egg and larval stages were 30·4 and 8·33 hours, respectively. The larva does not feed. Since protonymphs could not be induced to feed artificially and could not be recovered as identified individuals when placed on uninfested birds, no further work on the life-history was possible. From other experiments, it is concluded that the mites do not aestivate [*cf. R.A.E.*, B **24** 22]. The finding of heavy infestations on fowls living under natural conditions during June and early October supports this view and indicates that the mites remain on certain birds throughout the summer. It is possible that the decrease in their numbers during the summer is due to the greater health and cleanliness of the birds, which probably shake off many mites when taking dust baths. The mites will not infest chicks. Observations on the rapidity of spread and fluctuation in infestation in one fowl house are recorded in a table; they show that the infestation spreads rapidly from bird to bird, and that the degree of infestation increases rapidly on some birds and remains fairly constant on others, while certain birds remain free. Experiments on the behaviour of the mites apart from their hosts indicated that

they survive considerable periods of starvation, but that temperatures below 7°F. cause death in a short time and that the upper thermal death point lies between 104·2 and 108·5°F. From *post mortem* examinations and observations on the weight, egg production, and infestation of live birds, the author concludes that so many factors, such as heredity and general health, are involved that no definite conclusions can be drawn regarding the effect of mite infestation; he does not, however, support the view that *L. sylvarium* causes great economic loss, and suggests that mite infestation may be a consequence, rather than a cause, of lack of condition or ill-health. He confirms the fact that the mite readily attacks man, biting soft-skinned parts of the body and causing intense irritation. In comparative tests on the control of mites by treating the roosts with mixtures containing naphthalene [cf. 23 12] or paradichlorobenzene [24 22] or with 40 per cent. nicotine sulphate, only the last-named gave satisfactory results.

The following measures are recommended: Infested birds should be isolated and should not have the same attendant as uninfested birds. In infested pens, during frosty weather, the roosts, dropping boards and nest boxes should be scraped clean; and, about 20 minutes before the birds go to roost, the roosts, roost supports and lower front edges of nesting boxes should be painted by means of a small brush with nicotine sulphate, using about 2 oz. for every 50 birds. It is necessary to treat every infested pen on the same evening, and to make sure, so far as possible, that every bird goes to roost. A bird entering a nest box comes into contact with the nicotine sulphate on the front edge and is soon free from mites. Single birds may be treated by smearing a few drops of nicotine sulphate around the vent, under thighs and wings, and on the neck. All birds should be treated as soon as they enter winter quarters in the autumn, since they may have picked up infestation from wild birds. This treatment is also effective against lice. Wild birds should not be allowed to nest near poultry houses.

STELLA (E.). Contributo alla conoscenza degli Issodini della Campagna Romana. [A Contribution to the Knowledge of the Ixodids of the Roman Campagna.]—*Boll. Zool.* 9 no. 1-2 pp. 1-7, 7 refs. Turin, 1938.

Descriptions are given of six species of ticks collected by the author in the Roman Campagna and identified by her as *Hyalomma aegyptium*, L., on horses and cattle, *Rhipicephalus sanguineus*, Latr., and *Ixodes ricinus*, L., on dogs and sheep, *Rhipicephalus simus*, Koch, on sheep and goats, and *Haemaphysalis cinnabarinus* var. *punctata*, C. & F., and *Dermacentor reticulatus*, F., on sheep.

RONDELLI (M. Tonelli). Per una migliore conoscenza delle zecche italiane. [A Contribution to the better Knowledge of Italian Ticks.]—*Riv. Parassit.* 2 no. 3 pp. 233-241, 2 figs., 29 refs. Rome, September 1938. (With Summaries in French, English and German.)

The author criticises several points in Stella's paper (see preceding abstract). She states that *Rhipicephalus simus*, Koch, is an African species that has not previously been recorded from the Mediterranean

basin or from goats, and suggests that *R. bursa*, C. & F., was the species found on goats and sheep by Stella. She agrees with the view of Schulze [R.A.E., B 18 20; 23 139] that *reticulatus*, F., is not a species of *Dermacentor*, and considers that the tick of this genus recorded by Stella is probably *D. marginatus lacteolus*, P. Schulze, which is known to occur in Sardinia, Spain and Rhodes. She also considers that the species recorded as *Hyalomma aegyptium*, L., which is a parasite of tortoises [cf. 24 196], is probably *H. marginatum*, Koch.

CARPANO (M.). **Spirochetosi dei volatili in Albania. Ciclo degli Spirochetti negli invertebrati ematofagi trasmettitori.** [Poultry Spirochaetosis in Albania. The Cycle of the Spirochaetes in the blood-sucking invertebrate Vectors.]—*Riv. Parassit.* 2 no. 3 pp. 165-182, 1 fig., 2 pls., 22 refs. Rome, September 1938. (With Summaries in French, English and German.)

Spirochaeta anserina occurs in poultry, chiefly fowls and geese, in small foci throughout Albania. Particulars are given of the clinical aspects and diagnosis of the disease caused by this spirochaete, and of what are thought to be forms of the latter found in a few examples of *Argas persicus*, Oken.

PAPERS NOTICED BY TITLE ONLY.

RILEY (W. A.) & JOHANSEN (O. A.). **Medical Entomology. A Survey of Insects and allied Forms which affect the Health of Man and Animals.**—Demy 8vo, 2nd edn (revised), xiii+483 pp., frontis., 184 figs., 37 pp. refs. London, McGraw-Hill Pub. Co. Ltd., 1938. Price 25s. [Cf. R.A.E., B 20 112.]

BRUMPT (E.). **Le Plasmodium bubalis Sheather 1919, du buffle domestique d'Asie, peut-il évoluer chez les anophèles?**—*Ann. Parasit. hum. comp.* 16 no. 4 pp. 369-373, 1 fig., 14 refs. Paris, 1st July 1938. [Cf. R.A.E., B 26 253.]

HURLBUT (H. S.). **A Study of the Larval Chaetotaxy of *Anopheles walkeri* Theobald.**—*Amer. J. Hyg.* 28 no. 2 pp. 149-173, 4 pls., 6 refs. Lancaster, Pa., September 1938.

CERQUEIRA (N.) & ANTUNES (P. C. A.). ***Haemagogus tropicalis*, a new Species from Pará, Brazil (Diptera, Culicidae).**—*Proc. ent. Soc. Wash.* 40 no. 1 pp. 1-9, 19 figs., 5 refs. Washington, D.C., January 1938.

STENDER (M.). **Milbenerkrankungen unserer Haus- und Nutztiere.** [The Injuries caused to domestic Animals in Germany by Mites and Ticks (a general survey).]—*Z. hyg. Zool.* 30 pts. 9-10 pp. 255-264, 281-290, 11 figs., 16 refs. Berlin, 1938.

THOMPSON (G. B.) & PLOMLEY (N. J. B.). **A List of the Insect Ectoparasites from Australian Birds and Mammals.**—*Proc. Linn. Soc. N.S.W.* 63 pt. 3-4 pp. 105-127, 2 pp. refs. Sydney, 15th September 1938.

MEYER (J. R.). Tratamento das sarnas dos animais pelo timbó.
 [The Treatment of Mange in Animals by Means of Timbo.]—
O Biológico 4 no. 8 pp. 257–261, 2 figs. S. Paulo, August 1938.

In experiments in Brazil, the author found that extracts of timbo [*Lonchocarpus*], which contain rotenone, are effective against mites causing mange in various animals. Small animals are best treated by an ointment made by mixing the ether extract with lard or vaseline, and larger ones by a liquid consisting of an extract in alcohol. In both cases, frequent applications are required, and if the liquid fails to give control, supplementary treatment with the ointment is necessary.

BROWN (A. A. Forbes). Trypanosomiasis gambiensis. Some Observations in Uganda, and their Bearing on Prophylaxis.—*J. trop. Med. Hyg.* 41 nos. 12–18 pp. 200–207, 220–222, 234–237, 247–251, 265–270, 281–286, 296–301, 12 figs., 47 refs. London, 15th June–15th September 1938.

A very detailed account is given of sleeping sickness due to *Trypanosoma gambiense* in Aringa county in the West Nile district of Uganda, and of its vector, *Glossina palpalis*, R.-D., with a discussion of measures of control and recommendations for their modification.

The following is taken largely from the author's summary and conclusions: The disease is mild and its incidence is low to moderate, but it is widespread, so that there are doubtless many undetected cases that act as reservoirs. *G. palpalis* is widely distributed at altitudes below 3,000 ft., but its incidence everywhere is low. Abrupt variations in the volume of water in the numerous rivers and streams bring about the destruction of pupae and so prevent any permanent increase in the numbers of the fly. The rate of salivary gland infection is high, being at least 0·6 per cent., but the number of metacyclic forms observed in the glands is usually small. The high rate may be due to infection with *T. gambiense* from man or *T. brucei* from livestock.

It has been found that by clearing (debushing), the numbers of fly can be reduced to 10 per boy per day, a low figure meaning that flies are hardly seen at all and that natives using the clearings are practically safe. Further reduction would be almost impossible without undertaking the smoothing of banks and the removal of rocks, islets, logs, etc., to destroy the remaining resting places of the fly. The numbers in isolated bush can be reduced by hand-catching, although not to such a low figure if the natives are not supervised.

There is reason to believe that *G. palpalis* depends for its existence to a large extent on humidity, and that this restricts its movements, so that it seldom makes excursions from the river bed unless it is pursuing man or cattle. It prefers a mixture of light and shade, and the alternation of light and shade in the river bed causes a continuous movement up and down the course of the river. Fly-counts have shown that a density of 10 flies per boy-day can be attained by a clearing 10 yards wide on each side of small streams, and not more than 25 yards wide on main tributaries of the Nile, unless it is known that the river in question is readily filled by local rains. Block clearings 400 yards wide and 400 yards long have been found useless, the width being excessive and the length inadequate. Flies rarely reach the far side of a clearing 1,000 yards long. It is therefore suggested that at river crossings the clearing should be 10 yards wide on each

side of the river and at least 500 and preferably 1,000 yards long on each side of the crossing. The minimum area to be cleared (20,000 sq. yds.) is therefore no greater than in the present standard crossing clearing of about 100 by 200 yards, and there is five times the distance for the fly to migrate in order to reach the crossing. In the case of settlement clearings, it is suggested that these should be 10 yards wide on each side of the stream and of such a length that no house is within 500–1,000 yards of either end of the clearing. Thus, a strip clearing 8,000 yards long would cost no more to construct than a block clearing 400 yards square, but many more people could be settled along it and there would be less temptation to get water from uncleared parts of the river because they were nearer. The ill-effects of clearing on agriculture can be mitigated by a system of strip clearings 10 yards wide and 1 mile in length alternating with uncleared strips of equal length in which the fly is reduced by trapping and catching [cf. R.A.E., B 25 165]. Erosion is best prevented and clearings maintained by controlled grazing, since this promotes a grass succession in which creeping varieties are eventually established; these provide no shade for the fly and at the same time bind the soil. The livestock introduced would also act as a biological barrier by attracting the fly away from man. Clearings should always be carried out from the head-waters downwards, as otherwise the fly is driven upstream into the maze of tributaries.

CARDOSO (F. A.). *Sur le mécanisme de la transmission de la maladie de Chagas.*—*Ann. Parasit. hum. comp.* 16 no. 4 pp. 341–349, 20 refs. Paris, 1st July 1938.

The mechanism of transmission of *Trypanosoma cruzi*, the causal organism of Chagas' disease, from the Triatomid vector to man is disputed, some authors contending that it is by means of the bites of the insects and others that it is by means of their excreta. The literature in support of and against these two hypotheses is reviewed. In an attempt to settle the question, the author undertook a series of experiments on the infection of mice, using a Brazilian strain of *T. cruzi* and nymphs and adults of *Triatoma infestans*, Klug, reared in the laboratory. The bugs were infected by allowing them to feed on infected mice. Positive results were obtained in eight cases out of ten when infected excreta were placed on different mucous membranes and in ten cases out of ten when they were placed on scarified skin, but in no case when they were placed on unbroken skin. One positive result was obtained when each of ten bugs was fed on a different healthy mouse a month after it had fed on an infected one, but none when the same ten bugs were allowed to feed on ten other mice about a month later. A special method of feeding was used to prevent the possibility of the mice being contaminated by the excreta of the bugs. Dissection of these ten bugs revealed no trypanosomes in the salivary glands, although metacyclic forms were abundant in the faeces in the rectum. None of ten mice inoculated with the macerated stomachs of these bugs became infected, although a control inoculated with the faeces showed trypanosomes in its blood on the thirteenth day. It is suggested that since the positive result occurred in the first series of biting experiments and the negative results of stomach inoculations were not obtained until after the second series, there is a possibility that it

might have been due to the regurgitation of blood containing trypanosomes that had survived in the stomach since the infecting feed. It is concluded that transmission in nature probably takes place most frequently through the deposition of infected excreta on mucous membranes or scarified skin, although it may occasionally take place through the bites of infected bugs.

GABALDON (A.). Primer informe anual (1937) de la Division de Malariaología. [First Annual Report (1937) of the Division of Malariaology, Venezuela.]—*Publ. Div. Malariaiol.* no. 1, 197 pp., 31 figs., 9 graphs. Caracas, 19th April 1938.

During the last eight years, malaria has been responsible for about 14 per cent. of the deaths due to known causes in Venezuela. The Division of Malariaology was established in 1936, and its work by the end of 1937 had included 22,071 inspections of mosquito breeding places and the identification of 222,543 larvae and 21,126 adults. The Anophelines taken comprised *Anopheles albimanus*, Wied., *A. albitalis*, Arrib., *A. apicimacula*, D. & K., *A. argyritarsis*, R.-D., *A. bachmanni*, Petrocchi, *A. eiseni*, Coq., *A. mattogrossensis*, Lutz & Neiva, *A. mediopunctatus*, Theo., *A. neomaculipalpus*, Curry, *A. pseudopunctipennis*, Theo., *A. punctimacula*, D. & K., *A. strobli*, Root, *A. tarsimaculatus*, Goeldi, and *A. oswaldoi*, Peryassú. Details are given of the regional distribution and prevalence of the various species and of malaria, and, in several cases, of the measures taken, which included oiling and drainage of Anopheline breeding-places.

SEN (P.). On Some Physico-chemical and Vegetation Factors of the Breeding Places of *Anopheles sundaicus* Rodenw.—*J. Malar. Inst. India* 1 no. 3 pp. 257–260, 7 refs. Calcutta, September 1938.

The results of analyses of waters from the actual breeding places of *Anopheles sundaicus*, Rdnw., in and near Calcutta carried out during 1936 to determine hydrogen-ion concentration and content of chlorides and carbonates are discussed. The wide range of salinity, which varied from 634 to 16 parts chlorine per 100,000, with an average of 164·3, indicated the tolerance of the species to this factor. The figures for pH, which ranged from 7·7 to 8·5, with an average of 8·2, indicated a preference for alkaline waters. The content of carbonates varied irregularly and exhibited no apparent relation to pH. The essential factor appears to be the presence of such characteristic floating algae as *Enteromorpha*, *Oscillatoria*, *Lyngbya* and *Oedogonium*, which provide food for the larvae and protect them from their natural enemies. The removal of aquatic vegetation is therefore recommended as a control measure.

ROY (D. N.). A Note on the Larva of *A. varuna* Iyengar.—*J. Malar. Inst. India* 1 no. 3 pp. 269–272, 1 pl., 6 refs. Calcutta, September 1938.

Adults reared from larvae taken in Bengal and Assam appeared to be those of *Anopheles varuna*, Iyen., but since the larvae differed from those described for this species by Puri [*cf. R.A.E.*, B 19 227], possibly because his specimens were damaged, they are described in the present paper. They were found in stagnant water containing algae and other aquatic vegetation; they prefer shade, such as that provided by the overhanging branches of trees.

RUSSELL (P. F.), MENON (M. Kumara) & RAO (T. Ramachandra).
Epidemiology of Malaria in Pattukkottai Taluk, Tanjore District, Madras Presidency, India.—*J. Malar. Inst. India* 1 no. 3 pp. 285–326, 6 pls., 2 refs. Calcutta, September 1938.

In this first report on a study of malaria in the town and taluk (administrative revenue division) of Pattukkottai in south-eastern Madras, the general features of the area are discussed, a brief account is given of the Anophelines, and detailed analyses are made of spleen and blood-smear data obtained between July 1936 and March 1938. Malaria was not apparently of importance prior to the inauguration of an extensive irrigation scheme in 1933, but at the time of the investigations there was no part of the taluk that was free from the disease and in some villages it was hyperendemic. A list is given of the 12 species of Anophelines encountered during the survey. It is concluded from the results of 13,335 dissections that the only vector of importance is *Anopheles culicifacies*, Giles; 4 out of 5,676 guts and 5 out of 6,483 salivary glands of this species were infected. Out of 651 precipitin tests 394 were positive, of which 386 reacted to cow serum and only 1 to human serum. Infected mosquitos were found from August to January, but not from February to July. *A. culicifacies* breeds chiefly in irrigation water, not only in canals and channels, but also in waste and seepage water, and in certain reservoirs. It is also found in wells, and may utilise both wells and reservoirs during the dry season. Some breeding takes place in wet, fallow rice-fields and among rice plants during the first few weeks after planting. The following appear to be the chief causes that have led to an increase of malaria as a result of the irrigation scheme: the excessive amount of water permitted to run in the canals; the borrow pits dug in the course of embanking the canals, since these become filled by seepage water or by running water from minor channels; defective sluice gates that permit the water to flow where it is not required; canal banks that are not properly maintained; the lack of any planned system or effective scheme for maintenance of field channels, which are outside the jurisdiction of the Government; the complete absence of drainage channels for irrigation water; the raising of water levels in wells; the increased number of wells, which is due to the relative ease of construction when the water table is high; and increased wet cultivation.

IYENGAR (M. O. T.). **Studies on the Epidemiology of Filariasis in Travancore.**—*Indian med. Res. Mem.* no. 30, iv+179 pp., 12 pls., 24 figs., 56 refs. Calcutta, July 1938. Price 6s. 9d.

A detailed account is given of investigations carried out from 1931 to 1934 on the incidence and distribution of filariasis, and the factors determining filarial endemicity in Travancore State, South India [cf. *R.A.E.*, B 21 23, 193]. The first chapter includes notes on the topography, climate and population of the state, definitions of the terms used and a description of the procedure followed. The filarial endemicity rate is defined as the percentage of persons examined who show microfilariae in the peripheral blood, external or clinical symptoms of the disease, or both. Twenty out of the thirty districts (taluks) into which the state is divided were surveyed, including all those of importance from the point of view of filarial incidence, and the next three chapters deal, respectively, with the districts with an

extensive filarial incidence, those with localised endemic foci, and those with little or no endemic filariasis. For each district, they give a description of the area, information on the incidence of filarial disease and filarial infection, a list of the mosquitos dissected, showing those found infected (the species of mosquitos taken in each district are listed in appendices), and a summary of the situation.

The fifth chapter is devoted to studies on infection with *Filaria malayi* and is concerned mainly with the bionomics of species of mosquitos of the subgenus *Mansonioides* of *Mansonia*, which are the chief vectors of this parasite. In the sixth chapter, descriptions are given of the control measures instituted in a rural area, where the parasite concerned was *F. malayi*, in the urban area of Trivandrum, where it was *F. (Wuchereria) bancrofti*, and in a town in which both parasites occurred. In the last chapter, the findings are discussed at length.

In the course of this investigation 75 species and varieties of mosquitos were recorded from Travancore, of which 15 were found naturally infected with filarial parasites. In areas where *F. malayi* was present, *Mansonia (Mansonioides) annulifera*, Theo., *M. (M.) uniformis*, Theo., *M. (M.) indiana*, Edw., *Armigeres obturbans*, Wlk., and *Anopheles barbirostris*, Wulp, showed appreciable infection, the rate in the first two being 19.2 and 6.5 per cent. respectively. Under experimental conditions *F. malayi* developed normally in these five species and *A. hyrcanus* var. *nigerrimus*, Giles. Full-grown larvae were seen in the labium of *M. uniformis* 7½ days after the infecting feed; in the other species development took 10–13 days. Although larval development was completed in *Armigeres obturbans*, a large number of the larvae in the thoracic muscles were killed through chitinisation. Taking into consideration the relative abundance of the different species and their susceptibility to infection under both natural and experimental conditions, it would seem that *M. annulifera* and *M. uniformis* are the primary vectors, the former being the more important because it is the more prevalent. In areas where *F. bancrofti* is present, the species found infected were *Culex fatigans*, Wied., *M. annulifera*, *Anopheles subpictus*, Grassi, and *A. barbirostris*; full-grown larvae were found mainly in *C. fatigans*. Under experimental conditions, *C. fatigans*, *C. vishnui*, Theo., *C. gelidus*, Theo., *A. barbirostris*, *A. hyrcanus* var. *nigerrimus*, *A. subpictus* and *M. annulifera* became infected. *C. fatigans* was the most favourable host, the infection rate under both natural and experimental conditions being high and development of the filaria larvae normal and rapid. *M. annulifera* became infected and the larvae entered the thoracic muscles, but development was arrested at a very early stage. It is evident from these studies that the species other than *C. fatigans* are of no practical importance as vectors of *F. bancrofti*, though it may occasionally be transmitted by stray individuals.

The endemicity of *F. malayi* in a given locality is determined to a large extent by the prevalence of species of *Mansonioides*. The breeding of these mosquitos depends on the presence of ponds containing *Pistia stratiotes*, because, in nature, the female does not ordinarily oviposit except on the leaves of this plant and because the larvae are adapted to obtain their supply of oxygen from the air cavities in its roots [cf. 23 238], and on the presence in the ponds of suspended organic matter suitable as food for the larvae. In the absence of larval food, ponds containing *Pistia* do not, in most cases, constitute

breeding places. The most suitable form of organic matter in the region investigated is that produced by the rotting of coconut husks when steeped in water for the production of coir, which is one of the principal occupations of the rural population. Pollution by sullage and human and animal excreta also favours breeding, but to a smaller extent. The number of ponds is usually much larger in rural than in urban areas and the distribution of *Mansonioides* and consequently of *F. malayi* is, therefore, typically rural. In areas where infection with *F. malayi* is endemic, the rates in towns are definitely lower than in the surrounding country, and within the towns they are lower in the centre than at the periphery. The conditions that determine the presence or absence of ponds containing suitable organic matter in the different parts of Travancore are discussed. *Pistia* thrives in stagnant water with a low pH. Alkaline, saline and brackish waters are unfavourable, and, in localities where ponds are subject to tides or where the soil is saline, the incidence of *Pistia* and of the infection is low. Floods are also inimical since they either kill the plants or scatter them, so that there are few or none left in the ponds when the floods subside. The measure recommended for the control of *F. malayi* infections is the prevention of breeding of species of *Mansonioides* by removing *Pistia* from water collections.

The incidence of infections due to *F. bancrofti* is usually determined by the prevalence of *C. fatigans*, which breeds in stagnant water containing a high concentration of decaying organic matter. The association with urban areas of *C. fatigans* and consequently of infections with *F. bancrofti* appears to be due to the fact that the density of the population and therefore the quantity of sullage is greater than in rural areas. An inefficient system of open concrete drains in a town usually favours breeding. Earthen drains permit the drying up of sullage through percolation and evaporation; moreover, through the action of the soil bacteria, the sullage is clarified and the suspended organic matter is disintegrated or precipitated, so that the water is less suitable for breeding. A porous soil with a low subsoil water table facilitates a rapid drying up of the water in earthen drains. The utilisation of sullage water for irrigation sometimes produces intensive breeding, if no precautions are taken to prevent stagnation of the water. *C. fatigans* often breeds in large numbers in rice-fields bordering on towns when green manure and cow-dung are used as fertilisers. Infection with *F. bancrofti* may be prevented by controlling the breeding of *C. fatigans*, either through proper drainage or the treatment of breeding places with larvicides. An efficient system of subsoil sewers with treatment of the sullage at the outfall would be the most effective measure.

EVANS (T.). An Outbreak of Malaria due to *A. maculatus* breeding inside Jungle at Raub, Pahang, 1937.—*J. Malaya Br. Brit. med. Ass.* 2 no. 2 pp. 85-87, 2 pls. Singapore, September 1938.

A short account is given of an outbreak of malaria in the vicinity of the town of Raub, in which breeding of *Anopheles maculatus*, Theo., was found in two small areas within the neighbouring jungle [*cf. R.A.E. B* 27 12]. Control measures, which consisted of draining the seepage areas and oiling the stream weekly, brought about a remarkable reduction in the incidence of malaria in Raub. This and the fact

that the cases occurred in persons living nearest the jungle, indicated that the outbreak was due to mosquitos from these two breeding places only.

TOUMANOFF (C.). *Les résultats de l'essai d'élevage au laboratoire de A. hyrcanus var. sinensis Wied.*—*Rev. méd. franç. Extr.-Orient* **17** no. 4 pp. 355–364, 4 figs., 19 refs. Hanoi, 1938.

This paper, which is chiefly concerned with the rearing of *Anopheles hyrcanus* var. *sinensis*, Wied., in Indo-China, contains the same information as one already noticed [cf. R.A.E., B **26** 204], but also gives the results of rearing experiments up to a slightly later date (28th April 1938). Two females from Yên-Bay, Tonkin, which were apparently indistinguishable from those of *A. hyrcanus* var. *sinensis*, laid eggs with narrow decks that resembled those of *A. hyrcanus* var. *lesteri*, Baisas & Hu [cf. R.A.E., B **26** 200].

TOUMANOFF (C.). *Nouveaux faits au sujet de l'intercroisement de St. albopicta Skuse avec St. argentea s. fasciata Théob.*—*Rev. méd. franç. Extr.-Orient* **17** no. 4 pp. 365–368. Hanoi, 1938.

This paper gives the results of further experiments in Tonkin on the rearing of hybrid generations resulting from the crossing of females of *Aedes (Stegomyia) albopictus*, Skuse, with males of *A. (S.) aegypti*, L. (*fasciatus*, F.) [cf. R.A.E., B **26** 98]. In the course of six generations, a single female, obtained in the fourth generation, was the only example that resembled *A. aegypti* [cf. loc. cit.]. Cross-breeding of these mosquitos during the dry cold season proved more difficult than during the warm wet season; many females were not fertilised, and the number of the progeny was small. Cross-breeding was also found to be possible when adults of the 14th generation reared in the laboratory were used in place of adults reared from larvae caught in nature.

Renseignements relatifs aux index Aedes aegypti dans les divers pays d'Afrique pour 1937.—*Bull. Off. int. Hyg. publ.* **30** no. 9 pp. 1970–1978, 1 map. Paris, September 1938.

These further reports from official sources [cf. R.A.E., B **25** 253] give data on the occurrence of *Aedes aegypti*, L. in the Gold Coast, Nigeria, Kenya, and the Anglo-Egyptian Sudan.

Rapport sur les refuges pour moustiques dans les aéronefs.—*Bull. Off. int. Hyg. publ.* **30** no. 9 pp. 1998–2001, 2 pls. Paris, September 1938.

A close examination of the five types of aeroplanes used by Pan-American Airways revealed a surprisingly large number of situations, both inside and outside, more or less common to all types, in which mosquitos might take refuge. These are described in detail. It is concluded from a study of the conditions at the terminal airport at Miami, Florida, that only the most accessible spaces in the interior are treated against mosquitos and the exterior is entirely neglected.

The interior of the wings and the hollows inside such structures as the ailerons, rudders, etc., which may be entered by means of the small holes that permit the equalisation of the internal and external pressures or the openings through which the control cables pass, present the most probable harbourages for they are open to the exterior

and are, at the same time, protected from the violence of the wind when the aeroplane is in flight. No means of treating these situations seems practicable without altering the construction, for the spaces are large and the points of access rather small. However, a system of small pipes to distribute an insecticidal vapour throughout the wings might be incorporated in the machine and worked on the compressed air that is used to start up the engines in many aeroplanes, or by means of a portable reservoir of compressed air.

Ross (G. A. P.). *La destruction automatique des moustiques dans les aéronefs et le vecteur de la fièvre jaune dans les traversées aériennes en Afrique*.—*Bull. Off. int. Hyg. publ.* **30** no. 9 pp. 2002–2031, 3 figs. Paris, September 1938.

In the first part of this paper, the author discusses the recent increase in the volume of aerial traffic in Africa, the uncertainty as to the distribution and types of yellow fever in that continent, the increasing risks of the disease being transported by aeroplanes from the west to the east, the impossibility of destroying *Aëdes aegypti*, L., in the towns and villages in the infected parts of Africa, and the impracticability of preventing the distribution of mosquitos by measures taken at airports, because aircraft may land at unspecified places and many airports cannot be made to comply with the regulations of the International Sanitary Convention. He also gives the results of inspection of 84 hydroplanes that arrived at Durban between May 1937 and February 1938, showing that living insects were found in 17 out of the 44 that had been sprayed during flight or at the last port of call and in 11 out of the 40 that had not ; he concludes from this that the human element should be eliminated as far as possible from methods of spraying. The procedure employed for treating aeroplanes arriving at Durban, which is the southern terminus of the Imperial Airways Service, is described.

In the second part of the paper are given the results of investigations carried out in London and Durban to find an efficient method of applying an insecticide by automatic means that could be used during flight. Various objections to the use of automatic sprayers and the ways in which they were met are described. A spraying apparatus, weighing about 1 lb., has been designed by W. A. Larmuth ; it is worked by the bulb of an ordinary "sparklet" soda-water siphon containing carbon dioxide under a pressure of 400 lb. per square inch. The device is capable of spraying any quantity up to 100 cc. and may be installed in a fixed position or held in the hand. The insecticide is driven out so that the receptacle is emptied at each operation, and it is therefore simple to ascertain that a given quantity has been used. The whole amount is delivered in 5–15 seconds. Experiments in London showed that one of these devices should be installed in each compartment. With a view to obtaining a mist of insecticide so fine that it would be almost dry and could therefore be used in cabins, experiments were made with a patented apparatus (*Phantomyst*), in which the insecticide is aspirated into a receptacle and projected as a mist against a small ventilator. The coarser droplets adhere to the ventilator and drop back into the reservoir ; the others are in a form so fine that they appear like cigarette smoke. The disadvantages of this appliance are its weight and the fact that it is worked by electricity (a large type of sparklet bulb was tried, but proved

impracticable); it also works slowly and requires a considerable time in which to discharge the insecticide, the amount distributed depending on the time for which the apparatus is allowed to operate.

Eventually, Imperial Airways equipped a passenger hydroplane with Larmuth appliances, fixing one in each compartment except the cabins, and supplied a single Phantomyst sprayer for use in the latter. While this hydroplane was at Durban, experiments were carried out using an aqueous-base extract of pyrethrum [cf. 27 31] and an extract of pyrethrum with a base of carbon tetrachloride. The properties required in an insecticide for use in aeroplanes are listed, and the question of suitable solvents is discussed. Severe tests on inflammability showed that the extract diluted with water at the specified rate of 1 : 14 was as inflammable as the extract diluted with carbon tetrachloride at 1 : 4; both are non-inflammable from a practical point of view. Tests on a series of mixtures with carbon tetrachloride indicated that a dilution of 1 : 5 gave a sufficient margin of safety from fire. Dilutions with water were not tested. Carbon tetrachloride is not toxic to man at a concentration 100 times as great as that resulting from spraying, it was not observed to damage fabrics, its odour is negligible, the time during which ventilators must be closed for fumigation with it is short and it is quickly dissipated afterwards by ventilation.

In the tests in the hydroplane, the aqueous-base insecticide was used at a dilution of 1 : 10, since the dilution of 1 : 14 had been shown to be uncertain in its effects. The mixture was cloudy and was not soluble in water as specified. It has practically no odour, but a certain amount of discolouring of the furnishings was observed, and the spray nozzles became blocked.

The Larmuth apparatus distributed its charge of insecticide in a few moments in the baggage rooms, cockpit, passages, etc., and a dosage per compartment of 30 cc. of the tetrachloride-base extract (1 : 5) and 50 cc. of the aqueous-base extract killed all the mosquitos in 10 and 16-18 minutes, respectively. The mosquitos, which were chiefly *Anopheles gambiae*, Giles, were in cages of bronze gauze, placed wherever possible behind objects, in different parts of the aeroplane; they were kept under observation for 18 hours after exposure to determine the rate of survival. In the first test with the Phantomyst apparatus charged with the aqueous-base insecticide, the apparatus became blocked. In the second and third tests, it operated for 32 and 35 minutes, respectively; all the mosquitos had apparently succumbed, but several revived some hours later. When the same apparatus was charged with the tetrachloride-base extract, all the mosquitos in the cabins were killed when it operated for 14½ minutes. A new type of Larmuth sprayer, weighing about 1½ lb. but giving a finer spray, was tested in the same cabins, using the tetrachloride-base extract. It discharged the 30 cc. dose in each of the 3 cabins in a total of 26 seconds, and 2 minutes was required for recharging it; all the mosquitos were killed in 7 minutes.

ECKSTEIN (F.). **Bemerkungen über Biologie und Bekämpfung von *Anopheles maculipennis*.** [Remarks on the Biology and Control of *A. maculipennis*.]—Z. hyg. Zool. 30 pt. 11 pp. 321-332. Berlin, November 1938.

Experience in practical work against *Anopheles maculipennis*, Mg., in Germany has shown the author that many points concerning its

biology and control are not understood by some of the persons engaged on the work, and some, particularly with regard to the hibernation of the important race *atroparvus*, van Thiel, have not yet been ascertained. He therefore discusses the places in which the adult mosquitos are to be found in summer and winter, the breeding places, measures for control and personal protection by screens and mosquito nets.

With the cooler temperatures of autumn, *A. maculipennis* gradually begins to seek winter quarters, in October in the southern plain region of the Rhine and from the end of July onwards around Hamburg, though variations occur from year to year. The last males die in autumn. The females hibernate in sheltered places in the open as well as in buildings, and hitherto it has not been possible to ascertain what proportion to the total is represented by the females accessible to control measures. The females of race *messeae*, Flni., are found in dry cellars, sheds and hay-lofts and also in the field in places shielded from wind; thus they hibernate in cold positions and light does not seem to be a factor. On the other hand, those of race *atroparvus* do not apparently hibernate completely, for the females suck blood in winter, and at least some of them must therefore hibernate in warm places. In buildings in which *atroparvus* occurs in animal quarters, mosquitos are often found also in the cold hay-lofts, and it is uncertain whether or not they belong to the same race. Only comparatively few females are found in warm places, and if they actually represent all the hibernating individuals of *atroparvus*, it follows that winter measures must be particularly valuable. If, however, the mosquitos in the cool places are *atroparvus*, they would be of special importance in malarious districts, since, unlike those that hibernate where they can feed, they would have to enter animal quarters and dwellings to obtain the bloodmeal necessary for egg-maturation. Thus they would be liable to feed on man and so acquire and transmit malaria early in the season.

Regions in Germany where malaria has died out are regions with an unmixed *messeae* population. It is, however, difficult to assume the presence of *atroparvus* there in former times, as *atroparvus* is a coastal form. Drainage and other hydraulic work carried out during the past 80 years have been more unfavourable to the breeding places of *messeae* than to those of *atroparvus*, but the houses in rural districts now offer less favourable conditions to the adults of *atroparvus*, which are attracted by warmth.

VAN THIEL (P. H.). **Ueber das gemeinsame Vorkommen der Larven von *Anopheles maculipennis atroparvus* und *messeae* in Süßwasser.** [On the joint Occurrence in fresh Water of the Larvae of *A. maculipennis* race *atroparvus* and race *messeae*.]—*Acta leidensia* **12-13** pp. 271-278, 1 pl., 8 refs. Leiden, 1938.

In Holland, malaria is confined to the province of North Holland, where *Anopheles maculipennis*, Mg., race *atroparvus*, van Thiel, breeds in brackish water; its transmission is largely due to the fact that the females of this race feed on man in autumn [cf. *R.A.E.*, B **18** 53]. In the non-malarial districts race *messeae*, Flni., breeds in fresh water [cf. **24** 282], and it has been suggested that *messeae* would displace *atroparvus* if the water in the malarial districts were rendered more fresh [cf. **24** 283]. The author therefore carried out 29 experiments

with mixed batches of newly hatched larvae of the two races in various proportions. The larvae were placed in tap water in dishes in three series, so that the surface areas per larva were 4, 6 and 15 sq. cm., respectively [cf. 11 162; 19 143], but the percentage mortalities in the three series averaged only 15, 17 and 14. In no case did one race dominate the other, so that if the water in North Holland were rendered fresh, *messeae* would not thereby displace *atroparvus*. The results of the experiments were judged by identifying the pupal cases, and the characters differentiating these in the two races are described, but the adults were bred out to make certain that the pupae were viable.

SCHÜFFNER (W. A. P.) & SWELLENGREBEL (N. H.). *Verslag over de jaren 1936 and 1937 van de Malaria-Commissie uit den Gezondheidsraad.* [Report for 1936 and 1937 of the Malaria Commission of the Health Council of Holland.]—*Versl. Meded. Volksgezondh.* July 1938 repr. 26 pp. [Amsterdam, 1938.]

In the period August-November 1936, spraying against *Anopheles maculipennis*, Mg., race *atroparvus*, van Thiel, was carried out in about 100 houses at Marken and in 59 out of 771 at Uitgeest, the latter being selected according to the criterion of "four young children" [R.A.E., B 24 285]. At Uitgeest, all the Anophelines were killed in sprayed houses, and these remained less attractive to the mosquitos for a fortnight. This is ascribed to the liberal use of the pyrethrum-kerosene insecticide (Shelltox), 14-17 fl. oz. being used per house, which is 5-6 times the quantity needed to kill the mosquitos. Three weeks after the first application at the end of August, Anophelines were again numerous. After the second and third applications in mid-September and early October, they again reappeared; though their numbers were very small, this confirms the view that Anophelines may disperse from a focus of infection in autumn [25 285]. As spraying killed all the Anophelines in a house, any infected individuals found there later must, in the absence of a focus in the neighbourhood, have acquired the infection there after spraying. In 1936 there was no instance at Uitgeest of a focus in the neighbourhood, and it was confirmed that the malaria parasite requires about a fortnight to complete its cycle in the mosquito [25 284]. Successive applications of the spray should therefore be made at intervals of less than 14 days, particularly during the period before mid-September.

In 1937 spraying was carried out at the middle and end of August and September at Uitgeest, Marken and Akersloot, but data on the incidence of malaria in the year following that of spraying are given only for the work done in 1936. In that year there were at Marken 129 primary cases and 19 relapses from 1935; in 1937 these figures were 9 and 1, respectively. The corresponding figures at Uitgeest were 343 and 71 in 1936 and 31 and 25 in 1937. The less satisfactory results at Uitgeest are attributed to inadequate spraying. A striking example of the effect of spraying was provided by the hospital at Franeker. The average number of patients was almost the same in 1936 and 1937, but in a section sprayed in the autumn of 1936, malaria cases fell from 42 in 1936 to 8 in 1937, while in the other three sections, which were not sprayed, the number of cases of malaria increased in 1937.

It is concluded that spraying against Anophelines in a state of sexual inactivity in houses in late summer and autumn prevents from

50 to 92 per cent. of the malaria that would otherwise occur in the following year. Spraying is no longer in the experimental stage, and should be carried out as a routine measure by local authorities under expert supervision.

The transmission of malaria in autumn by race *atroparvus* [cf. 24 283] was confirmed by dissection of 46,807 females, of which 2,474 were infected, whereas only 1 of 2,888 females of race *messeae* was. It was also confirmed that larvae of *atroparvus* are 12 times as numerous in water with a chlorine content of 1,500 mg. per litre as in water in which the content is under 500 mg. This greater larval density is largely due to a preference to oviposit in very brackish water, and it is believed that a decrease of *atroparvus* will follow a decrease in the salinity of the water in the polders of North Holland through the agency of the almost fresh water of the Yssel lake [cf. preceding paper]. As the females of race *atroparvus* are zoophilous, they are likely to enter houses in unusually large numbers in new polder districts where relatively few animals, such as pigs, are kept. A comparison of conditions in the environs of Amsterdam (where there are many pigs and horses) in 1921 and at Uitgeest (where rabbits were the only confined animals) in 1935 showed that the percentages of Anophelines infected were similar, but that the average number per house in autumn (and therefore the average number infected) was twice as large at Uitgeest as near Amsterdam.

MISSIROLI (A.). Varieties of *Anopheles maculipennis* and the Malaria Problem in Italy.—*Trans. int. Congr. Ent.* 7 (2) preprint 20 pp., 1 pl., 1 diagr., 2 maps, 9 refs. Berlin, 1938.

The history of the explanation of the absence of malaria in places in Europe where *Anopheles maculipennis*, Mg., is present by the discovery that this species comprises several races is outlined, the characters distinguishing the races are described, and the relation of the distribution of each to particular types of breeding places, to climate, and to the incidence of malaria, and the degree of association of each with man are briefly discussed.

Malaria does not occur in Italy where *A. maculipennis maculipennis* alone is present. It is not endemic where race *messeae*, Flni., is prevalent, though transmission may take place if there is an influx of gametocyte carriers. Race *atroparvus*, van Thiel, may transmit the disease in regions where, on account of the microclimatic conditions in dwellings and animal quarters, or of the absence of shelter for animals, it is induced to live in close contact with man. On the other hand, there appear to be no areas in which races *sacharovi*, Favr. (*elutus*, Edw.) and *labranchiae*, Flni., occur in the absence of more or less endemic malaria. In central and southern Italy the disease has the same distribution as race *labranchiae*; in Venetia and Emilia it occurs in scattered localities along the shore where race *sacharovi* finds favourable conditions for development in the brackish water; and in Lombardy transmission by race *atroparvus* is sufficient to maintain a state of low endemicity, although malaria is absent in areas near Iolanda di Savoia where this race is abundant. Regression of malaria in Italy has been brought about in one or the other of the following ways: the impounding of sea water so that the salinity of swamps along the shore becomes sufficient to prevent the breeding of malaria vectors, as it has in the Venetian lagoon; the prevention by means of tide-gates

of the influx of sea water into canals flowing through coastal swamps, so that these contain only fresh water, as is the case over large areas of Venetia and Tuscany, where only races *maculipennis* and *melanoon*, Hackett, are present and malaria has disappeared; the flooding of swamps by streams carrying alluvial silt, as a result of which the brackish bottoms of the swamps become covered with a layer of humus 6 to 13 feet thick upon which rain water collects and races *labranchiae* and *sacharovi* are replaced by races *maculipennis* and *messeae*; and the drying of swamps by mechanical or natural drainage, which is one of the most common methods of reclamation, but is never satisfactory, because a large water surface is still presented by the drainage canals.

Reclamation by flooding of swamps takes many years, and the author was not able to observe the change in the Anopheline fauna in such areas. On lands spontaneously dried or drained mechanically, there is a continuous removal of chlorides from the surface of the soil, and the water, which was originally brackish, ends by containing only small quantities of chlorides and is therefore favourable for the breeding of races *maculipennis* and *messeae*. This process of soil-washing is favoured by irrigation, and owing to the thorough irrigation system at Maccarese, near Rome, race *labranchiae* is rapidly being replaced at the present time by races *maculipennis* and *messeae*. Race *labranchiae* is still present in the Agro Pontino, where slightly brackish water is prevalent, but the development of irrigation and continuous soil-washing will eventually bring about results similar to those obtained at Maccarese. In Venetia, the abundance of race *sacharovi* is inversely proportional to the degree to which the reclamation has progressed. It is found in large numbers when the work begins, but the numbers gradually decrease until it finally disappears on lands where a high state of improvement has been reached. A study of the sodium-chloride content of water in different areas has shown that race *sacharovi* disappears where land reclamation has reached an advanced stage and the water contains only traces of chlorides. In these cases the mosquito fauna may be composed of races *maculipennis* and *messeae*.

KING (W. V.). Experiments with Phenothiazine and Mosquito Larvae.

—*J. econ. Ent.* **31** no. 5 pp. 610–611, 3 refs. Menasha, Wis., October 1938.

A brief report is given of experiments in the United States in which several preparations of commercial thiadiphenylamine (phenothiazine) were tested against larvae of *Culex fatigans*, Wied. (*quinquefasciatus*, auct.) [cf. *R.A.E.*, B **23** 119; **25** 83]. The most effective was a solution consisting of 1 part thiadiphenylamine, 20 parts commercial sulphonated petroleum oil and 5 parts acetone. The solution was stirred into water, with which it is readily miscible, before evaporation of the acetone occurred. In laboratory experiments with larvae reared under natural conditions, this preparation killed all larvae in just over 2 hours when used at a dilution of 1 : 2,000,000. Larvae that had been reared on an artificial diet of yeast and dried blood were, however, much less affected by the larvicide, unless they had been removed from the food medium several hours previously. In a few tests made in storm-sewer catch basins that were filled with more or less polluted water and contained large numbers of larvae of the genus

Culex, a dilution of 1 : 500,000 gave a high mortality, but more experimental work will have to be carried out to determine whether the material will be of value in practical work against mosquitos in the field.

MELVIN (R.) & BUSHLAND (R. C.). Effects of Acidity, Alkalinity and Moisture Content of the Soil on Emergence of *Cochliomyia americana* C. & P.—*J. econ. Ent.* **31** no. 5 pp. 611–613, 1 ref. Menasha, Wis., October 1938.

In swampy areas of the United States, the population of *Cochliomyia hominivorax*, Coq. (*americana*, Cush. & Patt.) has been low during wet years, and the investigation reported in this paper was undertaken in the laboratory to determine the effect of the alkalinity, acidity and moisture content of the soil on the emergence of the fly. Mature larvae were placed in jars with clean sand saturated to different degrees with distilled water or with various dilutions of sulphuric acid or potassium hydroxide, and the percentage emergence observed. The results, which are given in a table, showed that the emergence of the flies decreased as the moisture content of the sand increased, until in the jars in which the sand was saturated only the larvae pupating on the top of the sand produced flies. It is concluded that larvae can withstand greater concentrations of KOH than of H_2SO_4 but that their great tolerance to both indicates that in nature the alkalinity and acidity of the soil have a negligible influence on emergence.

JOBLING (B.). On two Subspecies of *Culex pipiens* L. (Diptera).—*Trans. R. ent. Soc. Lond.* **87** pt. 8 pp. 193–216, 8 figs., 43 refs. London, 27th September 1938.

The nomenclature and status of the autogenous and anautogenous forms of *Culex pipiens*, L., are discussed in detail. Since these forms can interbreed [cf. *R.A.E.*, B **24** 98, 271; etc.] and are believed to do so in nature [22 61], they cannot be considered as distinct species [cf. **25** 136], and the author treats them as subspecies, using the names *C. pipiens pipiens*, L., for the anautogenous form that does not attack man and *C. pipiens molestus*, Forsk. (*autogenicus*, Roub.) for the autogenous form that attacks man.

Characters distinguishing the egg rafts, larvae of all four instars and adults of the two subspecies are described from four British strains of *C. p. pipiens* and from strains of *C. p. molestus* from Britain, Germany, Greece and Palestine. Descriptions are given of the adults. *C. p. pipiens* is distributed uniformly throughout the Palearctic region and is probably the only subspecies in the most northern parts of Europe; the adults are more resistant to low temperature than those of *C. p. molestus*. In the south of England, the females emerge from hibernation in April, and the first egg rafts appear in the first or second week in May. Oviposition gradually increases towards the end of July, then decreases sharply, and ceases completely in September. Females begin to enter sheltered places for hibernation in September, though a few are found in the open as late as the first week in November. The latest swarm of males was observed on 3rd November. This subspecies is the commonest mosquito of rural areas. It has almost completely disappeared from big towns with the introduction of drainage for rain water, but is still

common in the suburbs, where it breeds in rain-water tubs and tanks. All records show that *C. p. molestus* is most common in the Mediterranean parts of the Palearctic region. Its distribution is local in central Europe and it is probably not present in Scandinavia. It is not common in England, but has been found in some seaports and in some districts of London close to the Thames. This finding suggests that it is not native, but is introduced from time to time. Little is known of its habits in nature; although it is possible that it breeds continuously in winter in protected places in western Europe, it seems unlikely that it could survive in eastern Europe, where the winter is much more severe, unless the females hibernated.

Tables show the length of the egg, larval, pupal and adult stages (including the duration of each larval instar) of both subspecies at different temperatures. Neither was able to complete its development when the mean temperature was below 14°C. [57·2°F.]. The habitats of the larvae are discussed. In the laboratory, larvae of the auto-gogenous subspecies developed better and gave rise to larger adults when the infusion in which they were reared was made from organic matter and was turbid, whereas larvae of *C. p. pipiens* developed better when the infusion was less charged with fermenting organic matter. In highly polluted water there is usually a very high mortality among last-instar larvae and pupae of the latter, which, in England, seems to prefer rain water rather than the water of ponds and ditches. Dung infusion was not a suitable medium for the breeding of this subspecies. Experiments in which both subspecies were bred in many different solutions of sodium chloride showed that *C. p. molestus* can resist higher concentrations of salts in water than *C. p. pipiens*, and seemed to indicate that reduction in length of the anal papillae is proportional to the concentration of salts in the water [cf. 21 53, 74]. It is known that osmotic pressure increases with temperature, and further experiments proved that the temperature of the water affects the length of the anal papillae through the modification of the osmotic pressure, and also showed that equal differences of temperature produce equal variations in the papillae irrespective of the concentration of salts in solution. Long anal papillae in larvae of *C. p. pipiens* caught in nature were more often found in the spring generation (and sometimes also in those collected in the autumn) probably because of the much lower temperature and to the much lower salt content of the water owing to the more frequent rains. The length of the papillae in larvae from very polluted water was the same as that of the papillae of larvae bred in 0·25 or 0·5 per cent. concentrations of sodium chloride.

LAWRENCE (T. C.). A Report on *Supella supellectilium*, Serville (Orthoptera, Blattidae).—J. Kans. ent. Soc. 11 no. 4 p. 123. McPherson, Kans., October 1938.

Supella supellectilium, Serv., is a common household pest in the American tropics and has recently been troublesome in cities in Georgia, Texas, Arizona and Illinois. It is probably more widespread in the United States than is believed, its size and general coloration causing it to be confused with *Blattella germanica*, L. [cf. R.A.E., B 26 78]. Both were seen in a kitchen at Fort Leavenworth, Kansas, in 1933, and in 1936 the house was closed from 10th July to 15th August, during which time the temperature out of doors averaged

82.5°F. and reached 109° on two days and 112, 111 and 108° on three successive days. No more cockroaches were seen in the house until the end of 1937, when *B. germanica* appeared in some numbers and one immature example of *Supella* was taken. Thus closing the building during very hot weather seems to be sufficient to kill these pests. *S. supellectilium* was also collected from two houses in Lawrence, Kansas, in 1936.

BRUCE (W. G.) & EAGLESON (C.). A new Method of Feeding Adult Horn Flies, *Haematobia irritans* L., and Stable Flies, *Stomoxys calcitrans* L.—*J. Kans. ent. Soc.* **11 no. 4 pp. 144–145, 1 fig. McPherson, Kans., October 1938.**

The feeding of *Lyperosia (Haematobia) irritans*, L., and *Stomoxys calcitrans*, L., on small animals under experimental conditions often requires a considerable expenditure of time and labour and may be unsatisfactory. For this reason, the authors describe a cage in which approximately 500 horn flies or 250 stable flies may be conveniently maintained, and a method of feeding that has proved rapid, inexpensive and satisfactory. On the top of the cage is fixed a rack holding six tubes, of which alternate ones contain blood and water, respectively. The tops of the tubes are fitted with rubber medicine-dropper bulbs and the bottoms are in contact with a screened opening that is the only source of light for the cage. The unfed flies congregate on the screen under the opening and readily find the food supply ; the engorged flies move away from the light, thus allowing the others to feed. Three tubes of blood at a temperature of 25–40°C. [77–104°F.] and three tubes of water are ample for one feeding, and two feedings a day are sufficient. *L. irritans* seems to feed best on defibrinated bovine blood ; *S. calcitrans* feeds on defibrinated blood, but also thrives on acidulated bovine or swine bloods.

THOMSEN (E. G.) & DONER (M. H.). Breeding Houseflies. A simplified and more convenient Method of Rearing and Handling Flies for Peet-Grady Tests.—*Soap* **14 no. 10 pp. 89–90, 101, 1 fig., 5 refs. New York, N.Y., October 1938.**

The large number of tests that must be made to ensure the correct evaluation of the toxicity of a fly-spray using the Official Test Insecticide [*cf. R.A.E.*, B **27** 23] necessitates the rearing of large numbers of house-flies (*Musca domestica*, L.). To do this by the official method [*cf. 16* 254] requires large numbers of rearing jars, the services of an entomologist to supervise breeding, and in many cases, extensive installations. The method described is believed to be simpler and more economical and to produce healthier flies than the official method, with which it has been compared. A temperature of about 80°F. is maintained by means of an arrangement of thermostats, which is described. The humidity is kept at satisfactory levels by the moisture given off from the rearing medium. Eggs are obtained by placing a small glass vessel containing moistened bran in a stock cage of gravid females. A certain number of eggs, roughly counted, is transferred to each of the drums (5 U.S. gals. capacity) filled with Richardson's medium [**20** 261] that replace the battery jars as rearing

receptacles. The flies emerge into a stock cage (18 ins. high, 8 ins. square at the ends and screened on five sides), which fits closely into a tightly-constructed frame placed over the opening of the drum. A piece of tin serves as a sliding door to the cage. During the period of emergence, the cages are removed and replaced by empty ones every 24 hours; when emergence is at its height, over-crowding is prevented by distributing the contents of one cage into others. Usually the emergence of flies from a single drum lasts 10 days, and, unless too many maggots are present, 4,000-5,000 flies emerge.

TISCHLER (N.) & STONIS (J.). **Synthetic Insecticides. A further Study of the Value of Alpha Naphthyl Isothiocyanate in Fly Sprays.—**
Soap 14 no. 10 pp. 97, 99, 1 graph, 2 refs. New York, N.Y., October 1938.

Since previous work had shown that alpha naphthyl isothiocyanate was too slow in action to be used alone in sprays for the control of house-flies [*Musca domestica*, L.], experiments were carried out by the revised Peet-Grady method [cf. *R.A.E.*, B 27 23] to determine the toxicity of sprays containing various concentrations of pyrethrins plus 1 per cent. by weight of this substance and of various concentrations of pyrethrins alone, using the same sample of pyrethrum extract (which, at a dilution of 1:19, contained approximately 100 mg. pyrethrins per 100 cc.). The toxicity curves constructed from the data obtained show that at least 35 mg. pyrethrins must be combined with the 1 per cent. alpha naphthyl isothiocyanate to give a "B" insecticide [cf. 27 24] and that relatively small increases in the amount of pyrethrins (which add comparatively little to the costs) give considerably improved insecticides. A spray containing 100 mg. pyrethrins alone gave a 50 per cent. mortality, whereas only 37 mg. pyrethrins were necessary to give the same mortality when they were combined with 1 per cent. of the isothiocyanate. The highest concentration of pyrethrins alone (400 mg.) gave a mortality of 97 per cent., whereas an equivalent mortality required only 240 mg. pyrethrins in combination.

EAGLESON (C.) & BENKE (R.). **A Note on Rearing Houseflies.—**
Soap 14 no. 11 pp. 109, 119, 1 fig. New York, N.Y., November 1938.

It is suggested that a better random selection of flies for use in testing liquid insecticides against *Musca domestica*, L., would be obtained by taking samples as pupae rather than as adults. At Dallas, Texas, where approximately 2,500 flies are used in each test, larvae are reared in tubs of fermenting crimped oats. When the larvae have finished feeding and the first few have pupated, the whole culture is dumped on a large square sieve of $\frac{1}{4}$ -inch mesh wire netting mounted over a funnel, shaped like an inverted pyramid. The oats are spread evenly over the sieve in a layer 1-2 inches thick, leaving a margin 2 inches wide of exposed mesh to prevent the maggots from crawling up the sides. Aeration and desiccation of the medium and light from above cause practically all the larvae to drop through the sieve; they are guided by the funnel into a small pail containing a

few moist crumpled paper towels in which they pupate. When all have pupated, the pupae are sorted by means of two grain fanning-mill screens with openings of $\frac{6}{8}$ inch and $\frac{7}{8}$ inch, respectively. The abnormally large pupae are retained by the larger mesh and the abnormally small pupae pass through both screens. The pupae retained by the smaller mesh are uniform and clean, and any number may be removed with a very good chance of obtaining approximately equal numbers of males and females [cf. R.A.E., B 27 22].

HORSFALL (M. W.). **Observations on the Life History of *Raillietina echinobothrida* and of *R. tetragona* (Cestoda).**—*J. Parasit.* **24** no. 5 pp. 409–421, 3 figs., 13 refs. Lancaster, Pa, October 1938.

In the course of investigations on the fowl tapeworms, *Raillietina echinobothrida* and *R. tetragona*, which were carried out from November 1934 to May 1937 at Beltsville, Maryland, it was found that the ants, *Tetramorium caespitum*, L., and *Pheidole vinelandica*, For., were naturally infected with the cysticercoids of these Cestodes; dissections of 1,503 of the former and 368 of the latter showed the rates to be 2·5 and 5·9 per cent., respectively. The average number of larval tapeworms found in the ants was 2·1 and the maximum 9. Examination of larvae, pupae and worker ants from colonies kept in Petri dishes in which tapeworm segments were placed daily revealed one cysticercoid of *R. echinobothrida* in each of two workers of *T. caespitum*; it is possible, though not probable, that these ants were infected when collected 9 months previously, and all attempts to repeat the experimental infections were unsuccessful. Under natural outdoor conditions, the Cestodes were present throughout the year in fowls. The ants were active from 15th March to the end of December, but were only found infected from approximately 1st June onwards. Four possible means by which the ants could acquire infection are discussed; the most probable seems to be that the larvae eat or are fed the Cestode eggs in the nest and that the cysticercoids develop while the ants are maturing. This theory is supported by the fact that only infective and not developing stages of the tapeworms were found in the 1,800 workers dissected, and would also account for the lapse of time from 15th March, when the worker ants could first collect the segments, until 1st June, when the first infected ants were found, since it is reported that $2\frac{1}{2}$ – $3\frac{1}{2}$ months are necessary for the complete development of *T. caespitum*. The geographical distributions of the tapeworms and of the ants in the United States is indicated; the latter appear to be more widely distributed than the former.

CRAWFORD (M.). **The Fowl Tick (*Argas persicus*).**—*Trop. Agriculturist* **91** no. 2 pp. 113–116, 1 pl. Peradeniya, August 1938.

A short, somewhat popular account is given of the bionomics and control of *Argas persicus*, Oken [cf. R.A.E., B 26 90], which is very common on fowls in the Eastern Province of Ceylon, but has never been found in the wet, low country zone.

[FLEGONTOVA (A. A.).] **Флего́нто́ва (А. А.).** Les scarabées du genre *staphylin* comme régulateurs de la quantité de puces dans les terriers des spermophiles *Citellus pygmaeus* Pall. [In Russian.]—*Rev. Microbiol.* **16** (1937) no. 1–2, pp. 135–152, 2 graphs, 9 figs., 37 refs. Saratov, 1938. (With a Summary in French.)

[KIRSHENBLAT (Ya. D.).] **Киршена́блат (Я. Д.).** Staphyliniden in den Nestern von *Citellus pygmaeus* Pall. [Staphylinids in Nests of *C. pygmaeus*.] [In Russian.]—T.c. pp. 171–185, 18 refs. (With a Summary in German.)

[KIRSHENBLAT (Ya. D.).] **Киршена́блат (Я. Д.).** Bestimmungstabellen der Staphyliniden, welche in den Nestern von Säugetieren und Vögeln leben. [Keys to the Staphylinids that live in Nests of Mammals and Birds.] [In Russian.]—T.c. pp. 227–242. (With a Summary in German.)

In the first paper, an account is given of observations in 1936 on the part played by Staphylinid beetles in reducing the numbers of fleas in the nests of *Citellus pygmaeus* [cf. *R.A.E.*, B **22** 122] in a district in the Kalmuk Republic on the west of the delta of the Volga. Between 17th April and 14th August, 460 nests of this ground squirrel were examined; and 8 species of fleas and 11 species of Staphylinids, lists of which are given, were obtained. Observations showed that three of the Staphylinids, *Platyprosopus elongatus*, Mannh., *Jurečekia asphaltina*, Er., and *Philonthus scribae*, Fauv., prey readily on the fleas. The average number of fleas per nest was very high (90·3) in April, when the burrows contained the overwintered females of *C. pygmaeus* and their young, decreased sharply (to 16·3) in June, and rose again in July as new fleas began to emerge. Staphylinids were scarce in the nests in April, but abundant in May, June and July. There was a definite positive correlation between the abundance of the Staphylinids and that of the fleas in the nests. Laboratory observations showed that both adults and larvae of the Staphylinids readily attack both the larvae and adults of the fleas [cf. *loc. cit.*]. No preference was shown to any particular species of flea. The tendency of the beetles to feed on the fleas increased if the latter were abundant; if they were scarce, the beetles attacked one another.

On the basis of these observations, the author concludes that the activity of Staphylinids reduces the likelihood of fleas surviving in the nests of ground squirrels long enough to act as reservoirs of plague bacilli [cf. **21** 160, etc.] from one epizootic to another.

The second paper includes a list of 42 species of Staphylinids (of which one is described as new) collected in nests of *C. pygmaeus* in European Russia, chiefly the south-east, with notes showing whether they are typical or accidental inhabitants of the nests of this ground squirrel and whether they also occur in nests of other animals. Lists are also given of Staphylinids that were taken in nests of *C. citellus*, *C. fulvus*, *C. suslicus* and *C. dauricus*, some of them being among those recorded in the first list.

The third paper contains keys to 34 genera of Staphylinids, many or possibly all of which are found in the Russian Union and of which the species are constantly or not infrequently found in the nests of mammals or birds. In the case of 11 of the 12 genera that include species that are typical inhabitants of nests, keys to the species are also given.

[KOLPAKOVA (S. A.) & LIPPERT (N. P.).] Колпакова (С. А.) и Липперт (Н. И.). On natural Clearing of the Burrows of *Citellus pygmaeus* Pall. from Fleas on an Area from which all Ground Squirrels have been removed. [In Russian.]—Rev. Microbiol. 16 (1937) no. 1-2, pp. 153-170, 2 graphs, 23 refs. Saratov, 1938. (With a Summary in English.)

To supplement laboratory investigations on the longevity of fleas of steppe rodents [R.A.E., B 20 249], field observations on the survival of fleas in abandoned and inhabited burrows of *Citellus pygmaeus* were carried out from April 1933 till the beginning of July 1935 in a locality in the sandy region of western Kazakstan. For this purpose, an area of $3\frac{3}{4}$ acres, containing 154 burrows, was surrounded with a ditch, all the ground squirrels in it were exterminated, and, to prevent any animals from entering the burrows, iron tubes covered at the end with wire netting were inserted into the entrance holes. In the course of the period of observations, 92 nests from the experimental area and 94 nests from a control area were examined for the presence of the fleas. The species found in the empty nests were *Neopsylla setosa*, Wagn. (93.07 per cent.), *Ctenophthalmus pollex*, Wagn. & Ioff (4.40 per cent.), *Frontopsylla semura*, Wagn. & Ioff (1.47 per cent.) and *Ceratophyllus tesquorum*, Wagn. (1.06 per cent.), whereas the inhabited nests also harboured *Ctenophthalmus breviusculus*, Wagn. & Ioff, and *Ceratophyllus (Oropsylla) ilovaiskii*, Wagn. & Ioff. In the area freed from ground squirrels, the percentage of nests that did not contain fleas gradually increased from 10 in April 1933 to 100 in December 1934. In April 1934, ten months after the last ground squirrel had been caught in the area, only 6 nests out of the 28 examined contained fleas, all of which were *N. setosa*, their numbers varying from 1 to 18 per nest. Thus, most of the nests became free from fleas within a year of the extermination of the ground squirrels. In the control area, fleas continued to be present in burrows in the winter of 1934 and the summer of 1935. Though these findings tend to confirm the view that the fleas of ground squirrels do not live long under natural conditions [24 67], they do not exclude the possibility of the survival of fleas from one plague epizootic to another. It follows, therefore, that in districts in which intense epizootics among ground squirrels occur, it is desirable to destroy the ectoparasites in the burrows, as well as the ground squirrels, especially in years in which various rodents are abundant.

STARZYK (J.). Vitalité, virulence et pouvoir immunisant de *Rickettsia prowazekii*, conservés en dehors de l'organisme du pou.—Arch. Inst. Pasteur Tunis 27 no. 3 pp. 263-281, 12 figs. Tunis, September 1938.

Much of the information contained in these detailed descriptions of experiments on the conservation of *Rickettsia prowazekii* outside the body of the louse [*Pediculus humanus*, L.] has already been noticed from a shorter account [cf. R.A.E., B 25 156]. The figures given for the periods of survival of the virus in the form of rickettsiae in whole lice, in intestines and in excreta, dried over potassium chloride and kept at ordinary temperatures, are 30, 60 and 58 days, respectively. When these three types of material were dried and kept in a vacuum at 5°C. [41°F.], the rickettsiae in them survived for 6, 5½ and 4 months. The period of survival of the rickettsiae was determined by inoculation

of the material into fresh lice at different intervals (some 25,000 inoculations were carried out in the experiments on dried material), and their virulence and immunising power by inoculation of these lice into guineapigs. Conservation produced a decrease in virulence and vitality, but this was only temporary, for the cultures of rickettsiae regained their original properties from their second passage through lice.

These findings explain the appearance of isolated cases of typhus several months after the cessation of an epidemic and also demonstrate the truth of the popular belief that such cases are due to the use of clothes and sheep skins previously owned by persons who have died from the disease. The principles governing the disinfection of the houses and, particularly, the clothes of infected persons should be revised accordingly.

WANG (Lo-shan). **The Action of Paipu, *Stemona tuberosa*, on Lice.**—*Chin. med. J.* **54** no. 2 pp. 151–158, 6 refs. Peking, August 1938.

An account is given of experiments to test the value against *Pediculus humanus*, L., of alcoholic extracts of *Stemona tuberosa*, a plant that has long been reported in Chinese medical literature to possess insecticidal properties [*cf. R.A.E.*, A **26** 206]. Extracts were prepared by soaking 10, 25 or 50 gm. plant material in 100 cc. 70 per cent. alcohol for 3 days. In each experiment, 5 male and 5 female adult lice were immersed in them for different periods and were then kept under observation in a Petri dish lined with filter paper to absorb the excess fluid. Preliminary experiments had shown that lice can survive immersion in 70 per cent. alcohol alone for 2 hours. The 10 per cent. extract did not kill all the lice immersed for 3 minutes (the maximum period used), the 25 per cent. extract killed all lice immersed for 2 minutes within 24 hours, and the 50 per cent. extract killed all lice immersed for 1 minute within 2 hours. Eggs were immersed for 1 minute on one or more successive days in the 25 and 50 per cent. extracts; none hatched when immersed three times in the 25 per cent. extract or once in the 50 per cent. extract. An aqueous extract made by soaking the product for 3 days was much less effective; a 50 per cent. aqueous extract, boiled or unboiled, did not kill lice immersed for 10 minutes. No experiments were carried out on *Phthirus pubis*, L., but observation of cases in which 20 per cent. alcoholic extract was used against this louse on man indicated that it was even more susceptible than *P. humanus*. One application of a 25 per cent. extract killed all lice (*Haematopinus* sp.) on hamsters. The extracts do not appear to be toxic or irritating.

HINDMARSH (W. L.) & BELSCHNER (H. G.). **Studies on Cutaneous Myiasis (Blowfly Strike) of Sheep. I. Glycerine Diborate as a Preventive of Blowfly Strike of Sheep.**—*Vet. Res. Rep. Dep. Agric. N.S.W.* no. 7 pp. 41–43, 2 refs. Sydney, 1938. **II. The Ingestion of Boric Acid as a means of Prevention of Blowfly Strike in the Breech Region.**—*T.c.* pp. 44–48, 3 refs. **III. The Operative Procedure for the Control of Blowfly Strike of the Breech of Sheep (Mules' Operation).**—*T.c.* pp. 49–57, 5 refs.

A large scale experiment in Australia, described in the first paper, indicated that when sheep are swabbed in the breech region with the

diborate preparation of glycerine and boric acid diluted with alcohol [*cf. R.A.E.*, B 24 133], blowflies are repelled for periods up to two months after treatment. There was little strike during the year, and it is not known whether similar results would be obtained in a year when blowfly activity was intense.

Experiments described in the second paper showed that boric acid given by mouth to sheep was voided in the urine and that the concentrations in the urine might check bacterial growth, but when administered in drinking water in the field, it was of no value in preventing strike. Moreover, in a season favourable to blowflies, there is usually a certain amount of surface water available for drinking and green feed is also abundant, so that sheep may not use the water trough to any great extent, a point of considerable importance in the administration of a medicament in drinking water. No ill-effects on the weight or health of the sheep were observed.

In the third paper, an account is given of an experiment carried out in 1935-36 and 1936-37 to test the value of Mules' operation [*cf. 23 294*] in preventing infestation of sheep by blowflies. It is concluded that the removal of folds does render the sheep less liable to attack in the region of the breech, but since it is a measure that must be repeated each year as new lambs are reared, selective breeding is considered a more satisfactory means of producing the same result [*cf. 25 246*].

VANNI (V.). **Ricerche sulla Leishmaniosi cutanea endemica negli Abruzzi.** [Investigation on Cutaneous Leishmaniasis endemic in Abruzzi.]—*Ann. Igiene* 48 no. 9-10 pp. 520-528, 7 figs. Rome, 1938.

Notes are given on the incidence and clinical characters of cutaneous leishmaniasis in the province of Teramo, Abruzzi, on the Adriatic coast of Italy, where about 300 cases were observed during May-July 1938. The sandflies, *Phlebotomus perfiliewi*, Parr. (*macedonicus*, Adlr. & Thdr.) and *P. papatasii*, Scop., were common. In a batch of 20 sandflies dissected, one female of *P. perfiliewi*, the stomach of which was full of blood, was found to harbour numbers of flagellates in the pharynx. Their morphology and arrangement suggested that they were the leptomonad phase of *Leishmania tropica*, so that this sandfly would be infective [*cf. R.A.E.*, B 25 2]. It was caught in a cow-shed adjoining a dwelling in which were four children infected with cutaneous leishmaniasis.

HUGHES (A. W. McK.). **Disinfestation.**—Med. 8vo, 10 pp. Birmingham, Inst. Housing, 1938.

This is a somewhat popular address on the bionomics of the bed-bug [*Cimex lectularius*, L.] and its control, particularly on new housing estates, in England [*cf. R.A.E.*, B 23 141, etc.]. The author draws attention to the circular issued in May 1936 by the Ministry of Health recommending that the use of orthodichlorobenzene for fumigating inhabited houses [*cf. 23 142*] be discontinued, since this substance had been found to have certain toxic properties. It may still be used, however, in leaky uninhabited houses prior to demolition. With regard to fumigation with heavy coal-tar naphtha distillates [*cf. 25 177*],

it has been found that there are active materials in the fractions boiling both above and below ordinary commercial heavy naphtha, which boils between 160 and 190°C. At present an ordinary foot pump with a bucket feed is used to spray the naphtha, so that a large quantity may be applied in a short time. Diffusion screens of light cotton material on which the naphtha spreads are draped close to the walls. It is necessary to maintain a certain concentration of the gas in a room, and when this is lowered by diffusion of the gas through cracks and crevices or by absorption in the structure, it is built up again from the screens. Moreover, since the screens are near the walls, the greatest concentration is likely to occur where it is most needed.

PAPERS NOTICED BY TITLE ONLY.

WAGNER (J.). *Vierter Nachtrag zum [Fourth Supplement to the] Kataloge der palaearktischen Aphanipteren (Wien, 1930).—Konowia* **17** pt. 1 pp. 8–18, 3 pp. refs. Vienna, 15th August 1938. [Cf. R.A.E., B **23** 272.]

STELLA (E.). *Ixodoidea della Libia. Aggiunte al “Prodromo della fauna della Libia” di Edoardo Zavattari.* [Ixodoidea of Libya. Additions to E. Zavattari's “Prodromus of the Fauna of Libya” (records of 9 species).—*Boll. Soc. ent. ital.* **70** no. 6–7 pp. 123–124, 6 refs. Genoa, 15th July 1938.

COOLEY (R. A.) & KOHLS (G. M.). *Two new Species of Ticks (*Ixodes*) from California (Acarina : Ixodidae).*—*Publ. Hlth Rep.* **53** no. 36 pp. 1616–1621, 14 figs., 1 ref. Washington, D.C., 9th September 1938.

HUNGERFORD (T. G.). *Field Observations on Spirochaetosis [*Spirochaeta anserina*] of Poultry transmitted by Red Mite [*Dermanyssus gallinaceus*, DeG., in New South Wales].*—*Vet. Res. Rep. Dep. Agric. N.S.W.* no. 7 pp. 71–73, 2 refs. Sydney, 1938. [Cf. R.A.E., B **26** 81.]

HART (L.). *A short Note on the Transmission of the Fowl Spirochaete (*Treponema Spirochacta anserinum*) by “Red Mite” (*Dermanyssus gallinaceus*).*—*Vet. Res. Rep. Dep. Agric. N.S.W.* no. 7 pp. 74–75, 8 refs. Sydney, 1938. [Cf. R.A.E., B **26** 81.]

SCHIERBEEK (R.). *Trombicula vanommereni n. sp. : Rouget nouveau de la Guyane Néerlandaise.*—*Acta leidenstia* **12–13** pp. 266–270, 2 figs., 3 refs. Leiden, 1938. [See R.A.E., B **25** 277.]

VAN THIEL (P. H.) & SAUTET (J.). *Etude concernant l'existence des biotypes anthropophiles de l'*Anopheles maculipennis*.*—*Acta leidenstia* **12–13** pp. 279–286, 7 refs. Leiden, 1938. See R.A.E., B **25** 170.]

VAN THIEL (P. H.). *Quelles sont les excitations incitant l'*Anopheles maculipennis atroparius* à visiter et à piquer l'homme ou le bétail?*—*Acta leidenstia* **12–13** pp. 287–298, 6 refs. Leiden, 1938. [See R.A.E., B **25** 171.]

HO (Ch'i). *A new tree-hole breeding *Anopheles* [*A. sintonoides*, sp. n.] from the Island of Hainan.*—*Ann. trop. Med. Parasit.* **32** no. 3 pp. 279–285, 4 figs., 4 refs. Liverpool, 12th October 1938.

LEFEBVRE (M.). **Recherches sur le paludisme au Laos** [including a short section on Anophelines].—*Rev. méd. franç. Extr.-Orient* **17** no. 4 pp. 336–354, 3 graphs. Hanoi; 1938. [Cf. R.A.E., B **26** 202.]

LAZARUS (M.). **A Rapid Method of Mosquito Dissection** [to extract salivary glands and stomachs of Anophelines].—*J. Malar. Inst. India* **1** no. 3 pp. 267–268, 3 figs. Calcutta, September 1938.

RAO (B. A.), SWEET (W. C.) & RAO (A. M. Subba). **Ova Measurements of *A. stephensi* Type and *A. stephensi* var. *mysorensis***.—*J. Malar. Inst. India* **1** no. 3 pp. 261–266, 1 pl., 3 refs. Calcutta, September 1938. [Cf. R.A.E., B **26** 49.]

VAN HELL (J. C.). **Een vergelijkende studie van de pleuraharen van de Nederlandsch-Indische Anopheleslarven**. [A comparative Study of the Pleural Hairs of the Larvae of *Anopheles* of the Netherlands Indies].—*Meded. Dienst. Volksgezondh. Ned.-Ind.* **27** no. 4 pp. 476–492, 20 figs., 11 refs. Batavia, 1938.

VENHUIS (W. G.). **Het onderscheid tusschen de larven van *Anopheles ludlowi* varietas *sundaica* en de zoutwatervorm van *An. subpictus* Grassi in Nederlandsch-Indië**. [The Difference between the Larvae of *Anopheles sundacus*, Rdnw., and the Fresh-water Form of *A. subpictus*, Grassi, in the Netherlands Indies].—*Meded. Dienst Volksgezondh. Ned.-Ind.* **27** no. 4 pp. 498–505, 10 refs. Batavia, 1938.

SYDDIQ (M. M.). **Illustrations explaining an Article on *Siphunculina funicola* (Eye-fly)**.—*Indian med. Gaz.* **73** no. 8 pp. 468–469, 4 figs. Calcutta, August 1938. [Cf. R.A.E., B **26** 94.]

HERMAN (C. M.). ***Leucocytozoon anatis* Wickware, a Synonym for *L. simondi* Mathis and Leger**.—*J. Parasit.* **24** no. 5 pp. 472–473. Lancaster, Pa., October 1938.

COX (J. A.). **Morphology of the Digestive Tract of the Blackfly (*Simulium nigroparvum*)**.—*J. agric. Res.* **57** no. 6 pp. 443–448, 3 pls., 12 refs. Washington, D.C., 15th September 1938.

STONE (A.). **The Horseflies of the Subfamily Tabaninae of the Nearctic Region** [including 14 new species and 1 new variety].—*Misc. Publ. U.S. Dep. Agric.* no. 305, 171 pp., 79 figs., 24 refs. Washington, D.C., June 1938.

RAINEY (R. C.). **On the Changes in Chemical Composition associated with Larval Development in the Sheep Blowfly [*Lucilia sericata*, Mg.]**.—*Ann. appl. Biol.* **25** no. 4 pp. 822–835, 5 figs., 32 refs. London, November 1938.

Fly Spray Analysis. Pyrethrin Determinations in Referee Samples of Insecticide . . . a Study of Methods by the Pacific Coast Insecticide Association.—*Soap* **14** no. 10 pp. 91, 93, 95. New York, N.Y., October 1938.

LOWMAN (M. S.) & SULLIVAN (W. N.). **Pyrethrum Evaluation. Relation of Pyrethrin Content of Pyrethrum Flowers to their Toxicity to Mosquito Larvae**.—*Soap* **14** no. 11 pp. 89–91, 93, 119, 6 refs. New York, N.Y., November 1938. [See R.A.E., A **27** 134.]

WALKER (A. J.). **Fungal Infections of Mosquitoes, especially of *Anopheles costalis*.**—*Ann. trop. Med. Parasit.* **32** no. 3 pp. 231-244, 2 pls., 2 diagrs., 14 refs. Liverpool, 1938.

After briefly reviewing the literature on fungous infections of mosquitos, the author gives an account of observations made in Sierra Leone on 53 adults, 2 pupae and 543 larvae of *Anopheles gambiae*, Giles (*costalis*, auct.) and 3 adults and 1 larva of *A. funestus*, Giles, all of which were infected with sporangia. Four types of sporangia were observed; although the organism or organisms clearly belong to the genus *Coelomomyces*, they are not apparently identical with any of the species previously described [cf. R.A.E., B **9** 190; **16** 83; **27** 8]; the name *C. africanus*, sp. n., is proposed for the commonest of the forms. The appearance, development and distribution of the mycelium and sporangia are briefly described and illustrated. Two infected adult males of *A. gambiae* emerged from two pupae obtained in different breeding places in which numerous infected larvae were found. Infection in females occurs most frequently in the ovaries and causes sterilisation. General infections were always fatal, and less than 1 per cent. of the infected larvae developed to maturity. One larva showed one type of sporangia in the body cavity and a different one in the lumen of the gut. Attempts to grow mycelium and sporangia on artificial media have so far been unsuccessful. Uninfected larvae failed to develop infection when fed on sporangia or when maintained in various preparations of infected material. Infection developed in 2 out of 3 laboratory-bred larvae of *A. gambiae* remaining out of 21 isolated in a sieve floating in a breeding place that consistently produced infected larvae. A small number of laboratory-bred larvae became infected when placed in water, sediment, etc., from the same pool, from which all larvae were thought to have been removed but in which a single infected larva was later discovered. No new infections were obtained when fresh larvae were added to the same water some time later.

CORSON (J. F.). **A third Note on a Strain of *Trypanosoma gambiense* transmitted by *Glossina morsitans*.**—*Ann. trop. Med. Parasit.* **32** no. 3 pp. 245-248, 2 refs. Liverpool, 1938.

Since February 1937, three more cyclical passages of a strain of *Trypanosoma gambiense* from monkey to monkey have been accomplished by means of the bites of *Glossina morsitans*, Westw. [cf. R.A.E., B **25** 248], but, up to June 1938, the strain does not appear to have undergone any change in virulence or morphology.

HO (Ch'i). **The Significance of the Female Terminalia of House-flies as a Grouping Character.**—*Ann. trop. Med. Parasit.* **32** no. 3 pp. 287-312, 13 figs., 37 refs. Liverpool, 1938.

From an examination of the female terminalia, the author divides the flies of the genus *Musca* (*sens. lat.*) into three groups, the species of which deposit pedicelled eggs, non-pedicelled eggs, and larvae, and adopts the generic names *Eumusca*, *Musca* and *Viviparomusca* for these groups, respectively. A key is given to these genera based on the female terminalia, the female terminalia of each genus are described and illustrated, the species included in each are listed, and various subgenera are indicated. The differences between this grouping and that of Patton, based on male terminalia [cf. R.A.E.,

B 20 282], are shown in a table and discussed. A key, based on Patton's descriptions and illustrations, groups the males of the species into the three genera suggested by the author. The systems of classification used by various authors are compared in a table.

CHAGAS (E.) & others. *Leishmaniose Visceral Americana*. (*Relatorio dos trabalhos realizados pela commissão encarregada do estudo da Leishmaniose Visceral Americana en 1937.*) [American Visceral Leishmaniasis. (Report of the Commission charged with the Study of American Visceral Leishmaniasis in 1937.)]—*Mem. Inst. Osw. Cruz* **33** fasc. 1 pp. 89–229, 40 pls., 12 maps, 5 fold tables. Rio de Janeiro, 1938.

A full account is given of investigations in the region of the estuary of the Amazon in 1937 on the symptoms, pathology, treatment and epidemiology of the visceral leishmaniasis caused by *Leishmania chagasi*, many of the results obtained in 1936 [R.A.E., B 26 89] being confirmed. Surveys failed to demonstrate any infection in the town of Abaeté or the riverain areas subject to flooding, but dogs and cats, as well as man, were found to be infected in forest areas. The explanation of the incidence of the disease will probably depend on the discovery of the natural reservoir, which is presumably some wild animal, in view of the occurrence of isolated infections unconnected with other human, canine and feline cases. The number of wild animals examined was small, but a few forms suspected of being *Leishmania* were found in smears from the spleens of two wild rats (*Proechimys oris*).

The mechanism of transmission remained unsolved. Lists are given of a number of Arthropods examined, including a few examples of *Phlebotomus*, but no infection was found in them. In places where the disease occurred in man and animals, however, it was noted that *Phlebotomus longipalpis*, Lutz & Neiva, was almost the only domestic blood-sucking Arthropod present.

AMBROSIONI (P.). *Una epidemia familiare da Pediculoides ventricosus*. [An Epidemic of *P. ventricosus* in a Family.]—*Ann. Igiene* **48** no. 9–10 pp. 569–572. Rome, 1938.

Cases of dermatitis caused by *Pediculoides ventricosus*, Newp., that occurred in June in Rome were confined to members of a family and visitors who stayed in the house. The infestation was found to have originated from two cane arm-chairs, as débris shaken from borer holes in them contained numbers of the mite and also fragments of a small beetle, probably an Anobiid. Reference is made to observations on the hibernation of *P. ventricosus* [R.A.E., A 22 434], and it is suggested it had completed its winter cycle on the borer.

LIEM SOEI DIONG. *Onderzoeken over Triatoma infestans als overbrenger van enkele pathogene organismen en over de complementbindingreactie bij de ziekte van Chagas*. [Investigations on *T. infestans* as a Vector of some Pathogenic Organisms and on the Complement-Fixation Test in Chagas' Disease.]—*Proefschr. Univ. Leiden* [10+] 150 pp., 2 figs., 1 pl., 5 pp. refs. Utrecht, 1938. (With a Summary in English.)

This paper includes an account of experiments at Utrecht to ascertain whether Triatomids can transmit bacteria and spirochaetes. The bug

used was *Triatoma infestans*, Klug, and the experiments were made with paratyphus bacteria, "saprophytic acid-fast rods," *Spirochaeta duttoni* and *Leptospira icterohaemorrhagiae*.

In experiments in which the bugs were starved after the infecting feed, paratyphus bacteria were recovered from the rectum 34 days after the infecting meal, and were sometimes found in the stomach, while saprophytic acid-fast rods were still present in the intestines on the 41st day. In further experiments in which the bugs were allowed to suck fresh blood periodically, the paratyphus bacteria were retained in 12·5 per cent. of the adults for 132 days and were present in their excreta for almost as long a period; they must have multiplied in the bugs. Nymphs lost their infection sooner, only 8 per cent. being positive on the 55th day as compared with 44 per cent. for adults, but the excreta of one nymph were positive on the 76th day, and in another infection was found on the 83rd day in the thorax, stomach and rectum.

In biting experiments, the infected bugs were able almost regularly to infect mice with paratyphus bacteria during the first 5 weeks after the infecting meal, and some mice were infected on the 66th and 97th days. Single bugs could transmit the infection. Various experiments on the possible mechanism of transmission suggested that it was due to regurgitation. This view was confirmed by examination of a bug that had evidently transmitted a very large number of bacteria to a mouse, as the latter had died within three days. The proventriculus of this bug contained masses of bacteria and had apparently been blocked by a plug of them, whereas its salivary glands were free from infection. On the other hand, some of the bugs that had failed to transmit the infection had bacteria in the haemolymph and salivary glands. The author contrasts his results with those obtained by Mertens in experiments with *Triatoma rubrofasciata*, DeG., and plague bacilli [R.A.E., B 26 163].

Though large numbers of bugs were used in experiments with *Spirochaeta duttoni* and *Leptospira icterohaemorrhagiae*, neither was transmitted by biting, except for a single case of mechanical transmission of *S. duttoni* when the interval between feeds was only 5-30 seconds. Neither spirochaete was found in the haemolymph or excreta of the bugs, but both remained for 20 days in the intestines, so that there might be danger of contamination if a bug were crushed on broken skin.

[SIBIRYAKOVA (O. A.).] Сибирякова (О. А.). Quelques données sur la phénologie d'*Anopheles maculipennis* dans la région de la Sibérie orientale. [In Russian.]—Med. Parasitol. 7 no. 3 pp. 336-345, 11 refs. Moscow, 1938. (With a Summary in French.)

Observations on the seasonal occurrence of *Anopheles maculipennis*, Mg., in the province of Eastern Siberia were carried out in the summer of 1936 in five widely separated localities, one in the west, one in the centre and three in the east. *A. maculipennis* was the only Anopheline found, and examination of batches of eggs taken in two of the localities showed that they belonged to race *messeae*, Flni. The topography and climatic conditions of the five districts are discussed; they differ considerably, but there was no appreciable difference in the phenology of the mosquitos, which suggests that the data obtained are applicable

to the whole of Eastern Siberia. The overwintered females abandoned their hibernation quarters during the last three weeks of May. Emergence of first-generation adults began about the end of June, but was apparently very protracted, as larvae about to pupate were still found in the middle of July together with the young larvae of the second generation, the adults of which emerged throughout August. Cold weather and early frosts prevented the development of a third generation; no larvae were present at the beginning of September. The mosquitos entered hibernation quarters in late August and September.

[SHIPITZINA (N. K.).] Шипицина (Н. К.). A propos de l'action des poudres insecticides sur la larve d'*Anopheles* en relation avec le degré de dispersion des toxiques et de la concentration des substances ajoutées. [In Russian.]—*Med. Parasitol.* 7 no. 3 pp. 346–371, 1 fig., 12 graphs, 18 refs. Moscow, 1938. (With a Summary in French.)

The experiments described were carried out in the laboratory at a temperature of 25°C. [77°F.] with larvae of *Anopheles maculipennis*, Mg., race *messeae*, Flni., taken near Moscow. The larvicides tested were Paris green manufactured in the Russian Union and containing 50 per cent. As₂O₃, and a copper arsenite preparation (Arsmal with Acidol [*cf. R.A.E.*, B 22 38]) containing 8·6 per cent. As₂O₃ and 7·3 per cent. CuO. They were applied alone or mixed with talc in the proportion of 1 : 10 or 1 : 100, the rates of application being equivalent to 7 oz. of the undiluted larvicide and 4·7 and 43·2 lb. of the mixtures, respectively, per acre. The periods required to give 50 per cent. mortality of first-instar larvae when the larvicides were used alone, with talc 1 : 10 and with talc 1 : 100 were 32 minutes, 36 minutes and 19 hours for Arsmal, and 50 minutes, 60 minutes and 3½ hours for Paris green. When the tests were made with fourth-instar larvae, the corresponding periods were 80 minutes, 140 minutes and 24 hours for Arsmal, and 70 minutes, 80 minutes and 2¾ hours for Paris green. Thus, in spite of its lower arsenic content, Arsmal was more toxic to first-instar larvae than Paris green, when they were used alone or with 10 parts talc; this was solely due to the fact that it dispersed more evenly over the surface of the water so that more particles were caught by the mouth-brushes of the small larvae. When the larger quantity of talc was used, it formed a film on the water and hindered filtration by the larvae, reducing both the rapidity and the radius of action of their mouth-brushes. This effect was particularly pronounced in the case of the young larvae. Moreover, the concentration of the poison in the intestinal tract of the larvae decreased in proportion as the mixture contained more talc.

The rapidity with which food moves along the intestinal tract was studied by allowing fourth-instar larvae to feed in water coloured with Chinese ink. It was found that the amount of suspended matter filtered by the larva increased as its concentration in the water increased, but the rapidity with which the intestinal tract was filled did not increase correspondingly, because the movement of food through it was accelerated. In larvae that had swallowed particles of poison in quantities considerably exceeding the lethal dosage, filtration and the passage of food along the alimentary tract ceased in 10–20 minutes, and the poison did not even reach the mid-gut.

[KESHISH'YAN (M. N.).] **Кешишьян (М. Н.). The Detection of *Anopheles lindesayi* (Giles, 1900) in Tadzhikistan.** [In Russian.]—*Med. Parasitol.* 7 no. 3 pp. 373–385, 3 figs., 3 refs. Moscow, 1938. (With a Summary in English.)

The author found mosquito larvae that he believes to be those of *Anopheles lindesayi*, Giles, in collections made in three widely separated districts, one in the north and two in the middle of Tadzhikistan. They had been taken at the end of June in slowly moving flood water. Tables are given in which the characters of these larvae are compared with those of *A. lindesayi*, its varieties *nilgiricus*, Chr., and *cameronensis*, Edw., and the allied Algerian species, *A. marteri*, Sen. & Prun. The typical form of *A. lindesayi* was described from northern India, and the species has not hitherto been recorded from the Russian Union.

[DERBENEVA-UKHOVA (V. P.) & KUZINA (O. S.).] **Дербенева-Ухова (В. П.) и Кузина (О. С.). Quelques observations au cours de l'essai de lutte contre les mouches aux constructions nouvelles.** [In Russian.]—*Med. Parasitol.* 7 no. 3 pp. 399–405, 2 graphs, 5 refs. Moscow, 1938. (With a Summary in French.)

Work against *Musca domestica*, L., was carried out in two newly settled areas near Moscow in the summer of 1936. In one of them, the flies were breeding in great numbers in a refuse dump and large heaps of horse dung and old pig dung. The dung heaps were removed in June, and the area occupied by the stables and pig-sties was subsequently kept as free from dung as possible. As a result, the numbers of flies dropped sharply in July, though they are usually most abundant in that month, but it was found that they were still breeding in small quantities of horse dung that remained in cracks in the floors of the stables. The flies were much less abundant in the other settlement, as the horse dung was removed daily from the stable area, and the pig-sties and refuse dump were over half a mile away. The flies bred in refuse in boxes and ditches and in cracks in the floor of bakeries and communal kitchens. Trapping experiments showed that the number of flies in buildings is in inverse proportion to their distance from breeding places. The number of glass fly-traps required to give the highest possible catch of flies varied with the size of the room in which they were used ; thus, in a kitchen of 9,500 cu. ft., as many flies were caught with 20 traps as with larger numbers. The baits used, in order of efficiency, were bread moistened with rye-beer, bread moistened with water, and granulated sugar. In a kitchen in which work went on uninterruptedly by day and night, the numbers of flies caught were greatest between 11 a.m. and 6 p.m. ; relatively few flies were caught at night in spite of the bright light in the kitchen, probably because none flew in from outdoors.

[MIRONOV (V. S.).] **Миронов (В. С.). Ticks as possible Carriers of Spring Encephalitis.** [In Russian.]—*Med. Parasitol.* 7 no. 3 pp. 415–435, 8 figs., 132 refs. Moscow, 1938. (With a Summary in English.)

In the Province of Ussuri, epidemics of encephalitis occur in the spring, among people who work in primeval forests or frequent them.

No cases have been observed in localities outside the forests or in towns. The infection is probably contracted in the second half of April, as the epidemic begins early in May and reaches its peak at the end of the month. Mosquitos can hardly be vectors [cf. R.A.E., B 24 253], since, owing to the rather low temperature early in the spring, species of *Culex*, *Theobaldia* and *Anopheles* are scarce in April and those of *Aëdes* appear only at the end of May. Tabanids and other blood-sucking insects do not appear in April and do not reach their maximum abundance until July-August, when the epidemic has declined. It seemed possible, however, that Ixodid ticks, some of which are very abundant in the Russian Far East, might be the vectors, as most of them hibernate in the adult stage and resume activity in the spring as soon as the temperature rises a little, while tick bites are reported by all patients suffering from encephalitis.

The only Ixodid that could be found in July 1937 in a focus of the disease situated in very humid hilly country adjoining the lowland of Lake Khanka and covered with dense mixed forests of deciduous trees and conifers was *Ixodes persulcatus*, Schulze. Moreover, this was the predominant species in collections of ticks previously made in other foci, and all the known foci are in localities with the same physiographical character. In adjoining localities, which were of a different character and in which no infection occurred, the ticks found were *Dermacentor silvarum*, Olen., and *Haemaphysalis concinna*, Koch. The former was the only Ixodid present in the swampy country in the valley of the river Ussuri and the Khanka lowland, and the predominant one in areas cleared of forests in the open hilly country. *H. concinna* chiefly occurred in valleys in the mountainous country, in deciduous forests with an admixture of conifers.

In experiments, the disease was not transmitted to healthy mice by the feeding or injection of nymphs of *I. persulcatus* that had fed as larvae on artificially infected mice, but, in spite of this, the author considers that this tick is the probable vector in nature. He therefore suggests that men should not work in dangerous parts of the forest between mid-April and mid-June, when the ticks are most active, or that they should have overalls closely fitting at the neck and wrists, and should be examined daily for the presence of ticks. Places in forests used for camps should be drained and cleared of long grass, shrubs and débris, and cattle should be allowed to graze there so that ticks that collect on them can be destroyed. If this cannot be done, the ticks should be collected by dragging sheets over the grass and shrubs.

[DANILOVA (M. I.) & BUDUIMKO (F. A.).] **Данилова (М. И.) и Будымко (Ф. А.).** Le rôle épidémiologique de l'*Anopheles maculipennis* Meig. et de l'*Anopheles hyrcanus* Pall. dans les lagunes de la Mer d'Azov. [In Russian.]—*Med. Parasitol.* 7 no. 4 pp. 467-500, 2 graphs, 1 map, 12 refs. Moscow, 1938. (With a Summary in French.)

Mosquitos are very abundant in the low-lying plain situated in the delta of the river Kuban, on the sea of Azov, and malaria is endemic. The plain, which covers an area of about 2,260 sq. miles, contains large swamps and is intersected by a number of channels formed by

old river beds. The climate is moderately warm; the mean monthly temperature is over 10°C. [50°F.] for 7 months of the year and over 16°C. [60·8°F.] for 5 of them, and the relative humidity seldom drops below 60 per cent., even in the hottest months. With a view to determining the nature of the anti-mosquito measures to be undertaken in this area, investigations on the bionomics of Anophelines were carried out in the summer of 1936 in and near a village in the centre of the plain. The species found in abundance were *Anopheles maculipennis*, Mg. (of which races *messeae*, Flni., and *atroparvus*, van Thiel, were present) and *A. hyrcanus* var. *pseudopictus*, Grassi. *A. claviger*, Mg. (*bifurcatus*, auct.) was scarce. The larvae of *A. maculipennis* were numerous along the banks of the channels and in all shallow accumulations of water densely covered with plants of a favourable type, and especially round the edges of swamps adjoining the village. Larvae of *A. h. pseudopictus* chiefly occurred where tall plants rose above the surface of the water. In the village, adult mosquitos were invariably most abundant in the parts nearest to the swamps.

In day-time shelters, *A. maculipennis* was most abundant in June and July and its numbers sharply decreased in August. Race *messeae* predominated from May to early August, and *atroparvus* in August and September, when the water in the breeding places became brackish. The adults of *A. h. pseudopictus* appeared in June and reached their maximum abundance about the middle of August. Examination of the oviducts of the females to determine their age [cf. R.A.E., B 21 71] showed that 18 per cent. of those of *A. maculipennis* live long enough to permit the appearance of sporozoites of *Plasmodium*. In the case of *A. h. pseudopictus*, however, there was a complete absence of old females, and only about 2 per cent. lived long enough for oöcysts or sporozoites to develop. The day-time shelters of *A. maculipennis* consisted of inhabited houses, disused half-ruined buildings and particularly animal quarters. It was not observed in shelters outside buildings, whereas *A. h. pseudopictus* chiefly occurred in the field in the dense growths of reeds and other tall plants in the swamps, where it was active both by day and by night, though it was also found in all types of buildings. Of the adults of *A. maculipennis* taken in inhabited houses, 11·5 per cent. were males, and 6·8 per cent. of the females had not fed, 35·1 per cent. were freshly engorged, and 5·1 per cent. had mature eggs. The corresponding percentages were 19·9, 20·4, 32·2 and 9·06 for those taken in animal quarters, and 77·4, 71·5, 7·4 and 16·9 for those taken in disused buildings. In the case of *A. h. pseudopictus*, males were scarce or absent, but the corresponding percentages for females were 16·1, 22·5 and 3·06 in inhabited houses, 3·2, 27 and 0·62 in animal quarters, and 63·1, 11·4 and 0 in disused buildings.

Precipitin tests showed that *A. maculipennis* fed readily on man as well as on cattle, but did not attack poultry, though it was taken in small numbers in fowl houses. *A. h. pseudopictus* fed chiefly on cattle, and also on pigs, horses and poultry. Of the females from all types of day-time shelters that gave a reaction in precipitin tests, 53·2 per cent. of *A. maculipennis* and only 16·9 per cent. of *A. h. pseudopictus* had fed on man. A study of the spleen indices and parasite rates in different parts of the village showed that the incidence of malaria was highest near the swamp and higher near the channels than elsewhere. Malaria parasites occurred in 6 per cent. of the

persons examined. Of the mosquitos collected in inhabited houses, some were infected, and all of these were *A. maculipennis*, the sporozoite and oöcyst indices being 0·45 and 0·25, respectively.

[GORITZKAYA (V. V.).] **Горицкая (В. В.). Observations annuelles sur la biologie d'*Anopheles maculipennis* dans une localité non soumise aux mesures antipaludiques.** [In Russian.]—*Med. Parasitol.* 7 no. 4 pp. 501–513, 12 graphs. Moscow, 1938.

A detailed account is given of observations on *Anopheles maculipennis*, Mg., carried out from 12th June 1935 till 2nd June 1936 in a village on the Dnieper in southern Ukraine in which malaria was endemic. Of the 11 species of mosquitos found there, *A. maculipennis* was the predominant Anopheline, the others being *A. hyrcanus*, Pall. (both the typical form and var. *pseudopictus*, Grassi) which was abundant in the open but scarce in houses, and *A. claviger*, Mg. (*bifurcatus*, auct.), which was taken once only. Of 175 batches of eggs of *A. maculipennis*, 170 belonged to race *messeae*, Flni., 4 to race *atroparvus*, van Thiel, and 1 to race *maculipennis* (*typicus*). Numerous favourable breeding places, the character of which is described, occurred in low-lying land covered with trees and rough vegetation adjoining the village; larvae of *A. maculipennis* were especially abundant in shallow lakes with dense submerged vegetation, and also occurred in rice-fields. Pupation and emergence of adults was observed at the end of October at a temperature of the water of 16–19°C. [60·8–66·2°F.].

In the village, adults of *A. maculipennis* occurred in large numbers in inhabited buildings, storerooms, sheds and animal quarters, especially at the end of July and in August, when they also attacked man outdoors. To determine the importance of this species as a vector of malaria, females were taken in houses in each month from June 1935 to May 1936; those that did not contain blood were dissected on the day of capture, and those that contained blood (which were taken only in June–September) were dissected after they had digested it. Infected mosquitos that did not contain blood were found in May–October, but not in other months. The percentage infected was highest (1·2) in August; sporozoite infections became more numerous than oöcyst infections in September and October. Of the mosquitos that had contained blood, the percentages infected were 14 in June, 3·6 in July, 4·6 in August, and 0·8 in September. From August onwards an increasing percentage of the females showed developed fat-body; almost all did so in early October. The last males died out early in November. The hibernating females were most numerous in cow-sheds and pig-sties, but also occurred in numbers in dark corners on the ceiling in outhouses, cellars and rooms of inhabited houses in which the temperature was rather low during the winter. Only single individuals were present in inhabited rooms. No hibernating females of *A. maculipennis* were found in the field, whereas those of *A. hyrcanus* were abundant. As the mosquitos used up their fat-body during hibernation, they began to feed on blood; of those taken in inhabited houses, the percentage containing blood was small in December–February, but increased in March. At the end of the month, practically all mosquitos in cow-sheds were engorged. Ovi-position must have started about this time, as larvae in the first

and second instars were found in water close to the hibernation quarters in the second half of April. First-generation males appeared on 14th May.

[SHLENOVA (M. F.)] ШЛЕНОВА (М. Ф.). Sur la biologie des anophèles des environs de Sotchi. [In Russian.]—Med. Parasitol. 7 no. 4 pp. 514-529, 5 graphs, 1 diagr., 1 fig. Moscow, 1938. (With a Summary in French.)

In summer 1937, observations on Anophelines were carried out in and near the health resort of Sochi on the Black Sea coast. The species found, in descending order of abundance, were *Anopheles maculipennis*, Mg. (represented exclusively by race *maculipennis*), *A. plumbeus*, Steph., *A. claviger*, Mg. (*bifurcatus*, auct.), and *A. superpictus*, Grassi.

In the spring, only a few overwintered females of *A. maculipennis* were present, presumably because winter mortality had been high. The adults of this species were also scarce in June, possibly because many first-generation larvae were destroyed by the spring floods, but became numerous in July and reached their peak of abundance in the second half of August. Some females showed a developed fat-body by mid-September, and most of them entered hibernation in October. Inhabited houses and animal sheds were used as day-time shelters; the mosquitos predominated in the houses if the sheds were made of thin planks and exposed to the sun, but were almost confined to the sheds if they were of better construction. Precipitin tests showed that of the females containing blood, about 80 per cent. had fed on animals (chiefly cattle and pigs) and 20·2 per cent. on man. The latter percentage varied from 20 to 43 in houses and from 11 to 14·8 in animal quarters. Females containing oöcysts of malaria parasites occurred almost twice as frequently in houses as in animal quarters, and their numbers were almost directly proportionate to the percentages containing human blood. Females with sporozoites, however, occurred with equal frequency in houses and animal sheds. In the summer, there was a complete correlation between blood digestion and the maturation of the ovaries, but cases of gonotrophic dissociation [R.A.E., B 18 53] were observed in September and October.

A. plumbeus was present wherever forests or parks occurred. It bred in tree-holes and, to a less extent, in water in disused tubs and in depressions among the roots of trees. The adults were most numerous in May, when they belonged to the generation that had overwintered as larvae, and in October; they were scarce in summer when most of the breeding places in tree-holes had dried up. During the day, they sheltered in places with a relative humidity of 80-99 per cent., chiefly in tree-holes that did not contain water, among grasses and in uninhabited buildings at the bottom of a damp ravine. They were sometimes found in dark basements and once in a cow-shed. They entered inhabited houses at night or early in the morning, but did not stay there during the day. They avoided sun-light, and the females fed only when the relative humidity was high, whatever the temperature. Under conditions of sufficient humidity, they dispersed in the evening from their resting places; they covered distances of over half-a-mile in search of food and severely attacked man and animals in the course of 2-3 hours. At dawn and early in the

morning, however, they returned to their shelters. Precipitin tests showed that they were strongly attracted to domestic animals, as about 67 per cent. contained blood of cattle or pigs, and only 25 per cent. contained human blood. Of 282 females dissected, 2 harboured oöcysts.

Larvae of *A. claviger* occurred in all accumulations of water fed by springs, being particularly abundant in June and autumn; only a very few were found in July and August, owing to the drying up of the streams. Animal sheds were the chief day-time shelters, the females remaining in them apparently until the digestion of the blood was completed. They sometimes occurred in empty buildings, but never in inhabited houses. Of the engorged individuals, 95 per cent. contained blood of domestic animals and only 5 per cent. that of man.

A. superpictus, of which only 20 individuals were taken, was present in houses and pig-sties from the end of July to the end of September.

[REMENNIKOVA (V. M.).] Ременникова (В. М.). Contribution au problème des termes de la maturation du *Plasmodium vivax* dans l'*Anopheles maculipennis* conformément aux conditions naturelles du nord de la partie européenne de l'URSS. [In Russian.]—*Med. Parasitol.* 7 no. 4 pp. 530–540, 8 graphs, 2 figs. Moscow, 1938. (With a Summary in French.)

The effect of temperature on the transmission of malaria by *Anopheles maculipennis*, Mg., in the north of European Russia was studied in the summer of 1937 in the town of Sol'vuichegodsk, in the south-east of the Province of Archangel, this town being selected as it is the most malarious place in the northern zone. The race used was *messeae*, Flni.; the females of the overwintered generation were collected at the time when they abandon their hibernation quarters, and those of subsequent ones were reared from larvae or pupae taken in the field. The mosquitos were allowed to feed on persons infected with *Plasmodium vivax* and were then kept in large compartments containing a reservoir of water and a pig in a specially constructed insectary in which the microclimatic conditions were similar to those of the natural day-time shelters.

The insectary temperatures given are the averages of the mean daily temperatures. Even oöcysts did not develop in overwintered females in the insectary, where they were kept for 45 days at 15.5°C. [59.9°F.] or for 36 days at 20.4°C. [68.72°F.], but in the latter experiment the temperature for the first ten days averaged only 11.9°C. [53.42°F.]. In controls kept at 18–25°C. [64.4–77°F.], oöcysts and sporozoites occurred in 5 and 15 days. In the case of mosquitos of the first generation, which were fed in late June or early July, oöcysts and sporozoites first appeared in 3 and 11 days, respectively, at 23.9°C. [75.02°F.], and in 7–8 and 19–20 days at 19.9°C. [67.82°F.]. Sporozoites were still present in one mosquito dissected 60 days after the infecting feed. Mosquitos of the second generation that fed on 22nd and 23rd July harboured oöcysts and sporozoites after 7–8 and 17–18 days, respectively, at 20.2°C. [68.36°F.]. Oöcysts developed in 14–18 days in mosquitos fed in August, but no sporozoites developed in 56 days; the average insectary temperatures were a little below 16°C. [60.8°F.], which is the threshold of their development.

[MARKIN (A. V.).] **Маркин (А. В.).** Contribution au problème des variétés de l'*Anopheles maculipennis* dans la région centrale de l'Oural. [In Russian.]—*Med. Parasitol.* 7 no. 4 p. 610. Moscow, 1938.

Of 181 batches of eggs laid in June–September 1937 by females of *Anopheles maculipennis*, Mg., taken in cow-sheds near Nizhni Tagil' (on the eastern slope of the central Ural mountains), 55 per cent. belonged to race *maculipennis (typicus)* and the rest to race *messeae*, Flni. In egg-batches of *maculipennis*, the numbers of eggs averaged 212 and were largest between 10th and 20th July; in those of *messeae*, they averaged 228 and were largest between 1st and 10th July.

[KALITA (S. R.).] **Калита (С. Р.).** Variétés de l'*Anopheles maculipennis* des steppes de la région de Krasnodar. [In Russian.]—*Med. Parasitol.* 7 no. 4 pp. 611–614. Moscow, 1938.

Investigations on the races of *Anopheles maculipennis*, Mg., in the steppe zone north of the river Kuban were continued in the summers of 1936 and 1937 [cf. *R.A.E.*, B 25 198]. Of 2,377 batches of eggs laid by females collected in 8 different districts, chiefly in cow-sheds close to breeding-places, 51·8, 47·3 and 0·9 per cent. belonged to races *atroparvus*, van Thiel, *messeae*, Flni., and *maculipennis (typicus)*, respectively. The first two races were widely distributed, but *maculipennis* occurred in a few places only. With the exception of one pond, all the breeding places were rivers with slow-moving water and more or less uniform type of vegetation, consisting of *Phragmites communis*, *Scirpus lacustris*, *Typha latifolia*, *Ceratophyllum demersum*, etc. The analysis of samples of the water showed, however, that *atroparvus* bred chiefly in brackish water with a chlorine content of 68–128 mg. per litre, whereas *messeae* usually occurred in water with a chlorine content of only 30–59 mg.

[GERASIMOVA (A. A.).] **Герасимова (А. А.).** Sur les sous-espèces de l'*Anopheles maculipennis* observées dans la région du chemin de fer du nord. [In Russian.]—*Med. Parasitol.* 7 no. 4 pp. 614–615. Moscow, 1938.

Examination of batches of eggs laid by females of *Anopheles maculipennis*, Mg., taken in day-time shelters in localities situated along the railway from Danilov (south of Vologda) to Archangel revealed the presence of races *messeae*, Flni., and *maculipennis (typicus)*. The mosquitos bred in large natural swamps formed by rivers or lakes, in ditches with stagnant or slowly moving water near the railway stations, and in quarries and pits where the water was covered with vegetation.

[KALITA (S. R.).] **Калита (С. Р.).** Présence de l'*Anopheles plumbeus* Steph. aux environs de la ville de Krasnodar. [In Russian.]—*Med. Parasitol.* 7 no. 4 pp. 615–616. Moscow, 1938.

In the region of Krasnodar (western Caucasus), *Anopheles plumbeus*, Steph., has hitherto been recorded only from the environs of Maikop in the central part and from Sochi and Adler on the Black Sea coast. In the spring of 1938, however, larvae and pupae of this mosquito were found in the environs of the town of Krasnodar occurring in tree holes on both banks of the river Kuban.

[CHEBAN (K. S.)] Чебан (К. С.). Note sur la présence de l'*Anopheles bifurcatus* L. dans les steppes de la région d'Odessa. [In Russian.]—*Med. Parasitol.* 7 no. 4 p. 616. Moscow, 1938.

Larvae of *Anopheles claviger*, Mg. (*bifurcatus*, auct.) were found in March 1936, May 1937 and February 1938 in brooks in the central part of the Province of Odessa. In one instance, they occurred on 9th February at a depth of 20–24 ins. on the rock bed of a brook, the water of which was covered with a thin layer of ice and had a temperature of 0·5°C. [32·9°F.] at a depth of 8 ins. When kept at a temperature of 12°C. [53·6°F.], some of the larvae pupated on 24th February and adults emerged four days later. A few adults of *A. claviger* were also taken in 1937 in the northern and central parts of the Province. This species has not previously been recorded from the steppe region of the Ukraine.

[GASANOV (A. P.)] Гасанов (А. П.). Destruction des oeufs et des larves du moustique paludéen par la limnée *Limnaea ovata*. [In Russian.]—*Med. Parasitol.* 7 no. 4 p. 617. Moscow, 1938.

In the town of Makhach-Kala (Daghestan) on the Caspian Sea, Anopheline larvae are abundant in ditches with dense swamp vegetation and slowly moving water of subsoil origin, but it was noticed that they did not occur in those in which *Limnaea ovata* was present. The supposition that they were destroyed by this Gastropod was confirmed in repeated laboratory observations in the summer of 1935, when egg-batches and young larvae of *Anopheles maculipennis*, Mg., race *sacharovi*, Favr, were rapidly swallowed by it. It often occurs in stagnant or slowly moving water, and the author suggests that it may be of considerable value in Anopheline control. It is not affected by oiling or by dusting with Paris green unless the latter is heavily applied without a carrier.

[M. R.] M. P. Vectors of Leishmaniasis. [In Russian.]—*Social. Sci. Tech.* 6 no. 6 pp. 82–83. Tashkent, 1938.

A brief review is given of work on the transmission of visceral and dermal leishmaniasis with special reference to the Russian Union [*cf. R.A.E.*, B 17 9; 19 55, 193; 23 50]. In 1934–35, Khodukin and Sofiev found that of the sandflies tested in Tashkent, *Phlebotomus caucasicus*, Marz., was the most easily infected with canine leishmaniasis. In June 1936, females of *P. caucasicus* that had fed on an infected dog were allowed to feed on four dogs and five hamsters [*Cricetulus*], and observations on the animals were continued for 18 months, at the end of which period one of the hamsters (which are very susceptible to infection with *Leishmania*) was found to be infected.

Observations on cultures of *Leishmania* in internal organs showed that the Central Asiatic strain is morphologically intermediate between dermal and visceral leishmaniasis.

[REBRIN (M.)] Ребрин (М.). On the Acclimatisation of a new larvicidal Fish in Uzbekistan. [In Russian.]—*Social. Sci. Tech.* 6 no. 7 pp. 106–107. Tashkent, 1938.

In view of the successful results obtained in Dakar and Indo-China with the establishment of *Lebistes reticulatus* for the control of mosquito

larvae [cf. R.A.E., B 23 256; 26 20, 21], preliminary small-scale observations on the biology of this fish under natural conditions were carried out in Tashkent in 1937 by N. P. Sokolov. It was found that though *L. reticulatus* produces young more often than *Gambusia*, the number in each batch is smaller, though on the whole, the fecundity of the two species is practically equal. Fertility depends on the size, weight and age of the female. The summer temperatures in Uzbekistan appear to be suitable for acclimatising the fish, but its reactions to winter conditions are still unknown.

WEYER (F.). Das Verhalten von *Anopheles maculipennis* im Winter.

[The Behaviour of *A. maculipennis* in Winter.]—*Verh. dtsch. zool. Ges.* 39 pp. 99–106, 3 refs. Leipzig, September 1937.

In this paper are discussed the results of observations in Hamburg on overwintering females of *Anopheles maculipennis*, Mg., races *messeae*, Flni., and *atroparvus*, van Thiel. Hibernation in both races begins in September and ends in March, somewhat later in both cases for *messeae* than for *atroparvus*. Although females of race *messeae* are found in cow-sheds during the summer, it is not known what proportion of the total population they represent. In September, they leave the sheds and seek winter quarters in cool lofts, storerooms, etc. Suitable quarters are sometimes found only at considerable distances. Thus, females fly from the Rhine valley to the foot of the Black Forest to overwinter, this migration being probably stimulated by the need for a low humidity.

Females of race *atroparvus*, on the other hand, remain during the winter more or less near cattle, merely withdrawing to unoccupied stalls or to lofts above them, whence they occasionally emerge to take blood. The fat-body is equally large in both races at the beginning of winter, but whereas in race *messeae* it suffices for the whole winter, in *atroparvus* it is supplemented by this occasional feeding.

The separation of the two races for hibernation, however, is not complete. Although all the 300 females taken in winter in stalls in a cow-shed near Cuxhaven were *atroparvus*, a mixture of the two occurred in the loft above, as shown by the eggs deposited. In monthly examinations during the winter, 10 per cent. of all individuals contained fresh blood. The difference in behaviour of the two races is thus not a function of temperature.

Females of a strain of race *atroparvus* kept for over a year at Hamburg under conditions of constant warmth, humidity and lighting did not quite cease egg-production in winter, but many more blood-meals were needed for egg-maturation than in summer. Many of them produced fat instead of eggs. Attempts to keep females of race *messeae* through the winter under similar conditions were unsuccessful, as none survived for more than 88 days. In further tests, under artificial conditions during winter, they took blood readily from fowls, up to 87 per cent. of females feeding in a single night in some cases, and in 217 individuals taken in lofts, which were typical winter quarters for race *messeae*, 201 blood-meals from fowls and 65 from cattle were recorded during the winter. A similar test with females in the cow-sheds showed that 374 blood-meals on cattle and only 43 on fowls were taken. Overwintering females of race *atroparvus* kept at 20°C. [68°F.] digested a blood-meal in 2–3 days, which is no

longer than in summer, but those of race *messeae* required up to 10 days and many died during the process.

Egg-production in winter was slight. Only 39 batches were obtained from 470 females, those of race *messeae* that had taken blood appearing to oviposit more readily than those of race *atroparvus*.

The author considers that these differences in the behaviour of the two races in winter are determined hereditarily and that external conditions merely stimulate the hereditary biological characteristics.

WEYER (F.). *Die geographische Verbreitung der Rassen von Anopheles maculipennis in Deutschland.* [The geographical Distribution of the Races of *Anopheles maculipennis* in Germany.]—*Z. Parasitenk.* **10** pt. 4 pp. 437–463, 6 figs., 25 refs. Berlin, 1938.

In this paper are summarised and discussed the results of the author's investigations since 1931 on the distribution in Germany of the three races of *Anopheles maculipennis*, Mg., that occur there. Records of their occurrence are given for 160 localities. Race *atroparvus*, van Thiel, predominates on the coast [*cf. R.A.E.*, B **23** 32] as far east as the Frische Haff, but to the east of this, it is replaced by race *messeae*, Flni. In general, race *atroparvus* seldom penetrates many miles inland, except at the mouths of rivers, especially to the west of the Elbe. It also occurs in certain regions in the interior where the soil has a high salt content. Nevertheless, no direct relationship could be established between the breeding of race *atroparvus* and the chlorine content of the water [*cf. 23* 32]. Race *messeae* constituted almost the entire population in East Prussia and in the interior of Germany. It breeds in fresh water and is the commonest of the three races. Race *maculipennis (typicus)* is the least common [*cf. 22* 224], and did not occur at all on the North Sea coast. It was recorded mostly together with race *atroparvus* in saline regions and sewage fields in the interior, particularly in the Harz and the Black Forest [*cf. 24* 236].

LANGERON (M.). *Anophèles du Grand Atlas et de l'Anti-Atlas marocains.*—*C. R. Acad. Sci.* **207** no. 3 pp. 260–262, 3 refs. Paris, 18th July 1938.

In September 1936, the author investigated the Anopheline fauna in a number of villages at altitudes of over 6,000 ft., in the Great Atlas. An epidemic of malaria due to *Plasmodium vivax* was in progress. No adult Anophelines were taken in native dwellings, but larvae and pupae of *Anopheles claviger*, Mg., and *A. hispaniola*, Theo., were found in shallow accumulations of water in marshy places fed by streams. These breeding places are covered with snow for six months in the year.

Larvae of *A. sergenti*, Theo., were taken in water in a marshy area at an oasis at an elevation of 1,500 ft. in the Anti-Atlas.

BOYD (M. F.) & KITCHEN (S. F.). *Demonstrable Maturity of Gametocytes as a Factor in the Infection of Anophelines with Plasmodium vivax and Plasmodium falciparum.*—*Amer. J. trop. Med.* **18** no. 5 pp. 515–520, 2 refs. Baltimore, Md, 1938.

When mosquitos are applied to a presumably infective patient, a routine microscopic examination is made of the blood for exflagellating microgametocytes, it being assumed that, if such examinations

are positive, sexually mature macrogametocytes are also present. In this paper, data showing the percentages of individual mosquitos infected in 230 batches of *Anopheles quadrimaculatus*, Say, infected with *Plasmodium vivax* and 166 batches infected with *P. falciparum* are correlated with the positive or negative results of examinations of blood preparations made at the time the mosquitos were applied, figures being given not only for the year but also for each of the four quarters. Even when batches of mosquitos were infected to a high degree, exflagellation was frequently not demonstrated. The figures for the year show that exflagellation was demonstrated in 70.5 per cent. of the instances in which the batches of mosquitos became infected with *P. falciparum* and 56.5 per cent. of those in which they became infected with *P. vivax*. Since mature gametocytes must be present in the blood of all cases to which batches of mosquitos that become infected are applied, failure to observe exflagellation must have been due to deficiencies in the application of the technique. Demonstration of exflagellation was particularly successful in instances in which the mosquitos had been applied in the spring (March-May) and autumn (September-November) quarters, and it is thought that this difference may be attributable to the air temperatures prevailing at these periods. During the hot summer months and during the winter when the wards are artificially heated, the air temperature may not be sufficiently low to afford the contrast with the body temperature necessary to initiate the exflagellating process. This surmise is supported by the data on the infection of the mosquitos, which show that in the batches applied during the spring and autumn quarters to cases infected with *P. vivax*, a higher proportion of mosquitos became infected than in those applied during the winter or summer, and indicate that a similar difference may occur among those applied to cases infected with *P. falciparum*. The differences appear to be attributable to the varying readiness with which maturation changes can take place in the gametocytes withdrawn by the mosquitos during these different periods.

WEATHERSBEE (A. A.) & HASSELL (P. G.). Mosquito Studies. On the Recovery of Stain in Adults developing from Anopheline Larvae stained in Vitro.—*Amer. J. trop. Med.* 18 no. 5 pp. 531-543, 2 refs. Baltimore, Md., 1938.

With a view to discovering a means of marking Anopheline larvae in nature for the purpose of studying the drift or movement of the larvae, their development, and the subsequent rate of emergence, dispersion, flight range, and longevity of adults emerging naturally from a given place, experiments were undertaken on the staining of larvae. In this preliminary report are given the results of tests with 16 dyes on 38 lots of 4-10 larvae of *Anopheles crucians*, Wied., in the third or fourth instar. The larvae were placed in the stains for periods ranging from 24 to 480 hours and were then transferred to tap water. Wheat infusion was added both to the stain and to the tap-water as food for the larvae. After emergence, adults were either dissected at once to ascertain the presence or absence of visible stain, or kept in individual containers, fed on 5 per cent. dextrose solution and offered a blood meal once a week to determine whether the stain would fade and whether staining would affect longevity. The technique

used in dissecting is described, and the nature of the staining is discussed.

It was found possible to stain both third- and fourth-instar larvae so that the stain was recognisable in the adults that resulted from them. The staining is apparently internal, since it was seen in the walls of the abdomen and the tissues of the thorax, but not in the exoskeleton. It may also be seen, on microscopical examination of living examples in a vial or capsule, in the tissues underlying the ventral sclerite of the neck. Grubler's stock solution of Giemsa's stain at a dilution of 1 : 250 gave excellent results when the larvae were allowed to remain in the stain for 72 hours, or until they had pupated. Every adult emerging was unmistakably stained. Staining was recognisable in the adults up to 39 days after emergence when larvae had been stained in a dilution of 1 : 50. Wright's stain in dilutions of 1 : 15,000, 1 : 30,000 and 1 : 75,000 did not appear to be appreciably toxic to larvae exposed to it for 3-5 days, and excellent staining was secured. Staining was easily recognisable in adults up to 58 days after emergence and, in one specimen, 40 days after a blood meal. A stock saturated alcoholic solution of Methylene Blue diluted to 1 : 1,000 satisfactorily stained adults and was recognised in them up to 26 days after emergence.

In a supplementary note, the authors state that they have been able, since the paper was written, to stain larvae of *Anopheles quadrimaculatus*, Say, *Culex fatigans*, Wied. (*quinquefasciatus*, auct.) and *Aëdes aegypti*, L., using the same Giemsa stain at the dilution mentioned. The stain was recognised up to 13 days after emergence in all three, and some of the adults of the first two species were then still alive.

LEVER (R. J. A. W.). Mosquito Notes.—*Agric. J. Fiji* **9** no. 3 p. 21.
Suva, September 1938.

Adults of *Aëdes scutellaris*, Wlk., were reared from slightly alkaline tree-hole water in Suva and, on 27th June 1938, in a swampy area covered with *Inocarpus edulis* on Taveuni. *Megarhinus splendens*, Wied., which had been liberated in this area against *A. scutellaris* [cf. R.A.E., B **22** 94] is becoming scarce as a result of the depletion of the stand. A larva of *Megarhinus* that was given an adequate diet of larvae of *A. scutellaris* pupated after 6 weeks, the adult emerging after a further 6 days.

T[URBETT] (C. R.). The Giant Toad.—*Agric. J. Fiji* **9** no. 3 p. 29.
Suva, September 1938.

An experiment in Fiji showed that the tadpoles of the giant toad [*Bufo marinus*], which has recently been liberated there [cf. R.A.E., A **25** 588; **26** 59], do not attack mosquito larvae, even in the absence of other food.

HOFFMANN (C. C.). Nota sobre el anofelismo en el centro de Michoacán.
[A Note on Anophelines in the Centre of Michoacán.]—*Bol. Inst. Hig. Mex.* **2** no. 6 pp. 370-376, 3 figs. Mexico, D.F., December 1936. [Recd. December 1938.]

The State of Michoacán extends from the Pacific coast of Mexico about 180 miles inland. The Anophelines hitherto recorded are *Anopheles albimanus*, Wied., which is rare, but transmits malaria on the coast,

A. eiseni, Coq., which may transmit malaria locally [cf. R.A.E., B 25 183], *A. punctipennis*, Say, *A. pseudopunctipennis*, Theo., and *A. maculipennis* race *aztecus*, Hffm., the last two being of greatest importance as vectors of malaria. *A. pseudopunctipennis* has the widest distribution in the State and occurs at altitudes of up to about 6,000 ft. In Michoacán, there are two distinct Anopheline zones, that of the Río Lerma in the north and that of the Río Balsas in the south, and *A. pseudopunctipennis* abounds in both. *A. maculipennis* race *aztecus* has a limited distribution concentrated in the northern portion of the State, where swampy areas offer breeding conditions usually more favourable to it than to *A. pseudopunctipennis*, which prefers clearer waters. During the author's visit in June 1936, it was not observed in the region of the tributaries of the Río Balsas. Notes are given on the local occurrence of these two Anophelines and on the general distribution of the other three.

STROTHER-SMITH (F. F.). Anti-mosquito Measures in Cantonments with Special Reference to "Dry Day" instituted in 1927.—*Indian med. Gaz.* 73 no. 10 pp. 606–608. Calcutta, 1938.

A scheme for the organisation of measures for the control of Anophelines in cantonments in India is described, the special feature of which is the observance of a "dry day" every week, on which all receptacles for water, including drinking troughs for animals, reservoirs, channels and all depressions where water is lying must be kept empty for the three hours from 6 to 9 a.m. It is pointed out that the scheme was so successful at Sialkot, Punjab, for the years 1927–30 that mosquito nets were not necessary at any period during the year, and the number of cases of malaria fell from several hundreds almost to zero. The possible application of this scheme to cities and towns is briefly discussed.

MICHELSON (E. G.). An Apparatus for continuous Oiling of Streams.—*Indian med. Gaz.* 73 no. 10 p. 612, 1 fig. Calcutta, 1938.

The chief disadvantage of the oil screens that are generally used as a means of controlling the breeding of Anophelines on small, slow-running streams on tea estates in Assam is that a sudden storm may sweep away all the oil, leaving the stretch of stream below the screen full of larvae from the stretch further up, and unless oiling is carried out immediately, these give rise to adults and the malaria rate increases in consequence. This disadvantage may be remedied to a certain extent by the modification described, which has been found to work well. A tin with a capacity of a quart or rather more is fixed just above high-water level to each of the two uprights supporting the cross-bar from which the screen hangs. One end of a wick of double thickness $2\frac{1}{2}$ inches wide is held by a weight or some other means in the tin, which is filled with oil, and the other end is stitched to the canvas of the screen. A piece of wire twisted round the tin and allowed to project for 6 inches will prevent the wick resting against the tin and so wasting oil, and a small shade over each tin will prevent undue evaporation. With a wick of this size, one quart of crude oil will last for eight days and give a continuous coating to the stream for that length of time. The ideal interval between screens was found to be about 130 yards (though this distance will naturally depend on the number of bends and the variations in width of the stream), which

necessitates the use of 14 screens per mile and a weekly expenditure of 7 gals. oil. The even flow of the oil is unaffected by spates, and it is an advantage that when the water recedes, the oil carried up to spate level is left deposited on the banks.

HU (S. M. K.). **Studies on the Susceptibility of Shanghai Mosquitoes to experimental Infection with *Wuchereria bancrofti* Cobbold. V. *Culex fuscanus* Wiedemann.**—*Peking nat. Hist. Bull.* **13** pt. 1 pp. 39-52, 1 pl., 6 refs. Peiping, 1938.

During 1933-34, experiments similar to those already noticed [R.A.E., B **24** 48, etc.] were undertaken in Shanghai to determine the susceptibility to infection with *Filaria (Wuchereria) bancrofti* of females of *Culex fuscanus*, Wied., reared from larvae collected locally. Of the mosquitos examined, 6 showed no infection, 15 dissected between 18 and 28 days after the infecting feed contained only immature larvae (these were chiefly in the second instar [cf. **17** 10], and most of them appeared to be developing normally to the infective stage), and the remaining 69 harboured infective larvae, though in 29, dissected between 20 and 88 days after the infecting feed, all were dead. Living infective larvae were found in mosquitos dissected from 9 to 47 days after the infecting feed. Some of the larvae, including both immature and infective stages, had undergone chitinous encapsulation to a greater or less extent in most of the infected mosquitos. In only 7 of the 69 containing infective larvae were all the parasites free from chitinisation. In a few cases, chitinous encapsulation of immature larvae did not prevent their further development, since the chitinised cuticle was shed at the time of moulting, and in some others, partly chitinised infective larvae succeeded in breaking loose from the chitinous sheath. The extensive chitinisation, which was not encountered in some of the other species of mosquitos fed at the same time on the same patient, is likely to affect adversely any part that *C. fuscanus* may play in the transmission of *F. bancrofti* in the Shanghai region.

VAN DER EYDEN (T. J.). **De strategie der malariabestrijding.** [The Strategy of Malaria Control.]—*Geneesk. Tijdschr. Ned.-Ind.* **78** pt. 47 pp. 2936-2960. Batavia, 1938.

The author considers that the knowledge of the epidemiology of malaria is in a phase of stagnation owing to neglect of the basic principles laid down by Ross, whose papers have been obscured by the subsequent flood of literature. He therefore discusses mathematical formulae by which the various factors in the epidemiology of malaria can be evaluated. The subjects to which they are applied are the probability of infection; the increase and decrease in malaria cases; the spread of mosquitos over an area; the distance between breeding place and dwelling house; the spread of malaria over an area; and the control of malaria.

LANGERON (M.). **Evolution de microfilaires nocturnes chez les phlébotomes.**—*Ann. Paras. hum. comp.* **16** no. 5 pp. 477-478, 2 refs. Paris, 1938.

With reference to the finding of microfilariae of *Filaria (Wuchereria) bancrofti* in species of *Phlebotomus* in China [cf. R.A.E., B **26** 76, 145],

the author states that he had observed them in the stomach contents of sandflies caught in a room at Herakleion, Crete, in 1922. Examination of the blood of the three persons living in the room revealed microfilariae in the blood of the one who had resided for a long time at Alexandria, where *F. bancrofti* is prevalent. Circumstances did not permit the maintenance of the sandflies to determine whether the microfilariae were capable of developing in them. The sandflies collected at Herakleion comprised 228 unidentified females, and 198 males of *P. papatasii*, Scop., 25 of *P. sergenti*, Parr., 2 of *P. minutus*, Rond., and 1 of *P. perniciosus*, Newst.

MAYFIELD (R. B.). **Rat-fleas in Plymouth.**—*Parasitology* **30** no. 3 pp. 314–319, 1 plan, 7 refs. London, 1938.

The following is substantially the author's summary: The fleas found on 77 rats caught on the docks of Plymouth, England, were *Ceratophyllus (Nosopsyllus) fasciatus*, Bosc, *Xenopsylla cheopis*, Roths., and *Leptopsylla segnis*, Schönh. *X. cheopis* was found almost exclusively on rats trapped in one grain store and was obtained from them almost constantly throughout the period of the investigation (May 1935–May 1937). Six rats caught in the town of Plymouth harboured only *L. segnis* and *C. fasciatus*.

MELLANBY (K.). **Diapause and Metamorphosis of the Blowfly, *Lucilia sericata* Meig.**—*Parasitology* **30** no. 3 pp. 392–402, 1 fig., 14 refs. London, 1938.

When fully-fed larvae of *Lucilia sericata*, Mg., leave their food, they enter the prepupal stage. The prepupa is externally indistinguishable from a larva, but it does not feed and differs physiologically. After about three days, if conditions are favourable, the larval skin becomes rounded and hardened to form the puparium; this is the process that the author terms pupation. A diapause occurs in the prepupal stage under certain conditions. The experiments described in this paper were undertaken to investigate the nature of the diapause, its causes, and the conditions that terminate it.

The following is taken from the author's summary: Prepupae undergoing a diapause usually contain a higher proportion of dry matter than normal ones. Diapause is the effect of unfavourable conditions during the larval or prepupal period and occurs because the corpus allatum (Weismann's ring) is not producing the hormone necessary for pupation [*cf. R.A.E.*, B **23** 208]. It is ended when prepupae are removed from sand to empty tubes, probably because the corpus allatum is stimulated by a nervous reaction; the reaction is not due to an increase in the rate of metabolism. Low temperatures (5°C. [41°F.]) do not affect the hormone, but high ones (35–37°C. [95–98.6°F.]) destroy it. Prepupae of *L. sericata* have salivary glands that are dilated to nearly a quarter of the body size and serve as a source of water during the diapause. After desiccation, prepupae undergoing a diapause drink water and regain their original body weight. The water increases the volume of blood in circulation, and the amount of blood controls the size of the adult produced.

It is concluded from the experiments that diapause in nature probably ensues if the larvae are overcrowded or are in meat that is too dry, or if the prepupae are subjected to excessive heat or dryness.

The wandering habit of the larvae enables them to reach protected places for pupation, and the extra store of water in their salivary glands further adapts them to withstand unfavourable conditions. The ability to enter a diapause enables the species to survive conditions that might prove fatal to less resistant stages. The diapause presumably ends when, after a cool winter, the prepupae have acquired sufficient water to overcome any effects of desiccation and are stimulated to pupate by a suitable temperature.

GRANDORI (R.). L'azione disinfestante della calciocianamide contro la mosca domestica sperimentalmente dimostrata. [The disinfesting Action of Calcium Cyanamide against the House-fly shown experimentally.]—*Boll. Zool. agrar. Bacht.* **8** pp. 233–250, 5 diagr. Turin, 1938.

In the first part of this paper are described experiments in Italy on the insecticidal action of calcium cyanamide which indicated that insects are killed by ingesting a poison formed when this substance comes into contact with water [*R.A.E.*, A **27** 200].

Eggs and larvae obtained by allowing blow-flies to oviposit on putrefying meat in Petri dishes were killed by solutions of calcium cyanamide sprayed on to the meat or by a dust of equal parts of calcium cyanamide and wood ash placed in the dishes. In the latter case, the moisture of the meat must have been sufficient to liberate the poison.

A series of experiments made with cowshed manure containing numerous fly larvae are described in detail, the conclusions reached being as follows: Manure can be practically disinfested by calcium cyanamide. Great differences in mortality are obtained, depending on the manner in which the calcium cyanamide is applied to the manure. The best method is to apply a dust of equal parts of calcium cyanamide and an inert carrier to successive layers of manure 6–8 ins. thick and immediately to water with spring water until the manure is thoroughly soaked; it should not be so wet that the water runs off. A solution of calcium cyanamide is also fully effective, provided that it is not further diluted by rain. The amount of calcium cyanamide applied should be from 1 to $1\frac{1}{2}$ per cent. of the weight of the manure. Contradictory results obtained by other workers [*cf.* B **26** 224] are attributed to errors in technique.

Adult flies in cages were killed by allowing them to feed on figs wetted with a 5 per cent. solution of calcium cyanamide; a 10 per cent. solution repelled the flies. Complete mortality was also given by a bait containing 1 part molasses in 9 parts water and 1, 2 or 3 per cent. calcium cyanamide.

DE MEILLON (B.). Notes on African Ceratopogonidae (Diptera).—*Proc. R. ent. Soc. Lond. (B)* **7** pt. 12 pp. 266–270, 3 figs. London, 15th December 1938.

This paper comprises descriptions of two new species and of the hitherto unknown male of *Macroptilum aethiopicum*, Ingram & Macfie [*cf.* *R.A.E.*, B **11** 154], notes on the characters of *Parabezzia*, *Hartomyia* and *Eukraiohelea*, which are not considered sufficiently pronounced to differentiate them generically from *Stilobezzia*, and the statement that *Culicoides wansoni*, Goetgh. [**23** 207], the type of which has been examined, is a synonym of *C. distinctipennis*, Aust.

BARANOV (N.). **K poznavanju golubačke mušice VII.** (Biološka svojstva golubačke mušice i njezine seobe u g. 1938). [Contribution to the Knowledge of the Golubatz Fly. VII. (Biological Peculiarities of the Golubatz Fly and its Migrations in 1938).] —*Vet. Arhiv* **9** no. 3 pp. 105–125, 1 graph, 19 refs. Zagreb, 1939. (With a Summary in German.)

Investigations on the bionomics of *Danubiosimulium columbacense*, Schönb., in Jugoslavia [*cf.* *R.A.E.*, B **26** 33, 214] were continued in 1938. Previous investigations have shown that this fly is endemic in the area along the Danube near the Iron Gate [*cf.* **23** 276; **24** 276], the breeding places occurring within a stretch of some 60 miles in the gorge between the village of Golubatz and the town of Kladovo. In this area the winter is mild, the spring warm and the summer very hot; the amount of rainfall in the autumn is comparatively small, and winds that prevail in the adjoining regions during the year do not occur. The fly does not breed in other water, and its close association with this particular part of the Danube is probably due partly to local conditions, particularly the combination of a rapid current typical of mountain streams and a water temperature that is characteristic of large rivers. The breeding places are confined to certain biotopes, which are associated with the two ecological races of the fly [*cf.* **26** 33]. The larvae and pupae of race *litorale*, Baranov, occur on submerged branches of willows at depths of 8–40 ins. where the current is swift, although when the level of the river falls, the pupae are able to survive on exposed branches. The larvae and pupae of race *profundale*, Baranov, occur on the stones of the river bed at depths varying from 13 to 65 ft. in places in which the current is very swift, and the pupae are never found above the surface of the water. The adults are smaller than those of *litorale* and are considerably more aggressive [*cf.* **26** 34]; they are capable of flying several hundred miles, whereas those of race *litorale* do not migrate to any distance. A third form, which the author briefly describes and names *intermedia*, was observed near the Sip canal in 1938, the larvae and pupae occurring on stones in shallow places. The adults, which were as large as those of race *litorale*, but had the pronounced metallic sheen of race *profundale*, began migrating a considerable time before the adults of *litorale* (which is the earlier of the two races) began to emerge.

D. columbacense is always present in sufficient numbers to cause suffering to both man and cattle. Serious outbreaks, however, occur suddenly; no particular increase in the numbers of the fly is noticeable in the years preceding an outbreak, but probably a greater number of females are then capable of ovipositing and each of them lays more eggs than usual. The reproductive coefficient of the Golubatz fly has been determined as 140, but in years of normal emergence only 0·9 per cent. of the progeny survive as adults. Formulae based on meteorological data and the height and temperature of the water are given, from which may be calculated the number of adults emerging within a given period and the percentage of these that survive. Emergence depends on the conjunction of a favourable level and temperature of the water [*cf.* **22** 203; **25** 249], but the period immediately following emergence is the most critical, as the flies seldom survive if the temperature of the air is lower than that of the water, or if rain or wind drives them into the water [*cf.* **24** 276].

Previous investigations showed that the Golubatz fly spreads from its breeding places to adjoining districts within a radius of some 60 miles [25 249], the flies covering daily a distance of 3–4 miles. True outbreaks, in which only race *profundale* is involved, occur very seldom and are distinguished from the usual migrations by the existence in them of successive, well defined phases [cf. 25 249]. An outbreak results from a combination of favourable abiotic factors, the initial condition being that a great number of flies should have emerged in a short period between 15th April and 10th May. The rising of the flies high in the air, where they form swarms before migration begins, is an active process, but when in the air, they are carried passively by the wind. This flight lasts 5–8 hours, during which time the flies cover about 60–95 miles. The descent of the flies is also an active process, after which an ordinary migration begins within the new area, the flies covering some 3–6 miles daily. This phase lasts several days.

Very little is as yet known about the toxicity of the Golubatz fly. It appears that not all individuals, even of race *profundale*, are toxic and that there exists individual immunity in man and cattle from the effect of the bites of the fly. It is possible that this immunity is acquired as a result of the attacks of race *litorale*, which emerges earlier than race *profundale* and is the less toxic of the two. This hypothesis is supported by the fact that cattle suffer considerably less, and fewer animals are killed, within the area in which both races occur than in localities beyond its boundaries to which only race *profundale* migrates. The bites of other Simuliids present in those regions do not, apparently, render cattle immune.

In 1938, the first adults of the Golubatz fly, all of which belonged to the form *intermedia*, emerged on 13th April near the Sip canal, and the first migration took place between 13th and 29th April, the flies spreading for a distance of about 35 miles. An interruption, however, occurred owing to a sudden spell of cold weather and snowfall on 18th and 19th April. As the temperature of the water in the Danube became favourable and the water level fell, the adults of both race *litorale* and race *profundale* emerged, but large numbers of them died, as, owing to the low temperature of the air, they were unable to detach themselves from the surface of the water. The second migration, which occurred during a short spell of warm weather, lasted from 13th to 20th May, and the flies (chiefly race *profundale*) were found up to about 60 miles from the breeding place. Favourable conditions for the mass emergence and migration of the flies occurred in the first half of June, but by that time practically no more larvae or pupae were present in the breeding places. The fly did not, therefore, appear in large numbers and did not spread any further. No losses of cattle were reported.

BEDFORD (H. W.). **Report on Medical Entomology.**—*Rep. Sudan med. Serv.* 1936 pp. 81–84.

BEDFORD (H. W.). **Medical Entomology.**—*Rep. Sudan med. Serv.* 1937 pp. 77–83. Khartoum [1938].

The routine and research work carried out by the medical entomologists for the years 1936 and 1937 is briefly reviewed. Notes on

insects identified include the record of a single specimen of *Glossina morsitans*, Westw., from a locality in the Nuba Mountains from which none had been obtained for many years, and the record of *Xenopsylla nubica*, Roths., a flea taken on rats in Juba that has not previously been collected in the Sudan.

Collections from commercial aircraft comprised 741 insects in 1936, of which 49 were mosquitos (but not *Aëdes aegypti*, L.) and 873 in 1937, of which only 7 were mosquitos. In an experiment begun in October and discontinued in December 1936, in which an artificial pool with a surface area of approximately 12 sq. yds. and a depth of 2 ft., containing no vegetation, was stocked with *Gambusia affinis* and examined twice weekly, mosquito larvae from 1 to 5 days old were found at each inspection from 26th October to 28th December. It is concluded that this fish cannot be relied on to control breeding. The experiment also indicated the presence of gravid female mosquitos throughout the period; it is not known whether this was the result of constant immigration from breeding areas outside Khartoum or of continued production of ova by the same females over a long period.

An account is given of the results of investigations on Anophelines in the Gezira irrigated area, along the banks of the Blue Nile and at the Sennar Dam Reservoir. Of the Anophelines that occur in the Gezira, *Anopheles gambiae*, Giles, greatly outnumbers the others in the irrigated area and is the only proved vector of malaria. Of the 12,247 specimens identified in 1936, it constituted 92 and *A. pharoensis*, Theo., only 6 per cent. Dissection of 528 females in 1936-1937 revealed an infection rate in the salivary glands of 1·1 per cent. It breeds throughout the year, and adults may be found in houses from August to April. Although there are thousands of irrigation channels of standard size, watered from the same source and treated in approximately the same manner, a larval survey showed the distribution of breeding to be very uneven and indicated distinct localisation round certain centres of human habitation, particularly during the period November-April. Although apparently ideal breeding places, such as stagnant pools, were seen in the remainder of the area examined, none contained larvae. Along the Blue Nile, the chief Anopheline breeding places during most of the year are mud, sand and rock pools in which *A. gambiae* predominates. Seven species of Anophelines occur at Sennar, but *A. pharoensis* predominates in the town, and over 80 per cent. of the larvae in the reservoir are probably of this species. The chief breeding place of the Anophelines is a large area of the grass, *Echinochloa stegnina*, growing in the reservoir.

In the 1937 report, more details are given of the breeding places of some of the species of Anophelines, and the seasonal prevalence of larvae of *A. gambiae* in 1936 and the adults of the same species in 1937 are discussed. Experiments on measures of control are briefly reviewed; the efficacy of dusting with Paris green diluted with sifted river silt carried out in 1936 was indicated by the reduced numbers of larvae and adults of *A. gambiae* that occurred in the experimental area in 1937. Although the use of Paris green throughout the Gezira would probably be impracticable, it might be advantageous in certain areas, such as the localised breeding centres of *A. gambiae* already mentioned. Recommendations are made regarding the practical application of control measures in relation to the seasonal prevalence of mosquitos.

[SYMES (C. B.)] **Report of the Section of Medical Entomology for the Year 1937.**—*Rep. med. Res. Lab. Kenya 1937* pp. 15–17. Nairobi, 1938.

This report on routine work includes brief notes on Anophelines and other mosquitos. *Aëdes aegypti*, L., was found breeding in a mine at Kakamega in rock pools 240 feet below ground level, and adults of certain other Culicines were found at a depth of 650 feet. Work on elimination of *Glossina palpalis*, R.-D., by the block method [cf. *R.A.E.*, B 25 165] was continued in the forest area of the Kuja River; density there has been reduced to an almost negligible figure, but the area is so large that complete elimination of residual flies may take a considerable time.

MULLIGAN (E. J.). Annual Report of the Veterinary Department, Kenya, 1937.—Med. 8vo, 121 pp., 1 fldg. map. Nairobi, 1938.

A severe outbreak of Rift Valley fever occurred in November in sheep in the Gilgil-Elmenteita area. At the time, mosquitos were exceedingly numerous in the vicinity of Lake Elmenteita; those collected were chiefly *Aëdes durbanensis*, Theo. Inoculation into lambs and mice of females of this species caught near sheep pens showed that some of them harboured the virus; but although little difficulty was experienced in inducing them to feed on lambs and calves, no transmission by biting occurred. Females of the same species were fed on an infected calf and, after being maintained for 14 days (during which time they had access to cotton wool soaked in a solution of glucose), they were placed on two successive evenings on a lamb. Nine fed on the first occasion and three on the second, but the lamb did not become infected, although it was afterwards proved to be susceptible.

Unsuccessful attempts were made to transmit specific transmissible petechial fever (a disease of cattle to which sheep and certain smaller animals are susceptible) by the bites of the ticks, *Rhipicephalus appendiculatus*, Neum., *R. pulchellus*, Gerst., *R. simus*, Koch, *R. evertsi*, Neum., *Amblyomma variegatum*, F., and *A. gemma*, Dön. Adults of *Boophilus annulatus decoloratus*, Koch, that had engorged and dropped from an infected bovine were inoculated into a susceptible animal, which contracted the disease, doubtless as a result of the inoculation of fresh blood ingested by the ticks. Negative results were obtained when susceptible sheep were inoculated with suspensions of *Stomoxys*, *Culex* and *Anopheles* collected on a farm where an outbreak occurred.

Experiments in which various stages of *R. appendiculatus* were exposed to a low temperature for different periods [cf. *R.A.E.*, B 26 26] were continued. Engorged females oviposited when returned to a temperature of 24–27°C. [75·2–80·6°F.] after having been exposed to 1–4°C. [33·8–39·2°F.] for 9 days; most of the eggs dried up, but some hatched. After exposure for periods of up to 8 days, females usually laid viable eggs, though the numbers hatching were sometimes low and at times the larvae survived for a few days only. Exposure of eggs for 6 hours did not prevent hatching. At 24–27°C. larvae take usually 7–9, but sometimes 12, days to reach the moulting stage. When engorged, larvae were exposed to cold for more than 3 days, about 50 per cent. failed to moult and died.

Further experiments on the transmission of African Coast fever were made by W. Fotheringham and E. A. Lewis. Batches of engorged larvae of *R. appendiculatus* that had been exposed for 3 days to 1–4°C. immediately and at different intervals after dropping from an infected host were returned to the incubator and fed as nymphs on the ears of susceptible cattle. The disease was transmitted by all batches but one. Thus, exposure to cold for 3 days does not prevent the development of *Theileria parva* in this tick. *T. parva* was also transmitted by *Hyalomma anatomicum*, Koch, and *H. dromedarii*, Koch.

A brief account is given of the distribution of *Glossina* in four different areas, based on surveys made by E. A. Lewis, and of the control measures recommended, together with notes on the experiments that are being carried out in the Lambwe Valley on the control of *G. pallidipes*, Aust. [cf. 26 27].

All stages of *Psoroptes ovis*, Hering, were found in a quantity of hair and scab from the infra-orbital fossae of a sheep, which showed a few old lesions but no mites on its body. It seems, therefore, that the mites leave the body of the sheep after a time and some seek shelter in the infra-orbital fossae, or that the mites already in the fossae remain there when conditions on the other parts of the body become unfavourable. They do not remain quiescent in this situation, but continue to feed and multiply.

SOUTHWELL (T.) & KIRSHNER (A.). A Guide to Veterinary Parasitology and Entomology for Veterinary Students and Practitioners.—
Demy 8vo, xvi+176 pp., 123 figs., 12 diagrs., 4 refs. London, H. K. Lewis & Co. Ltd., 1938. Price 10s.

The second edition of this elementary work has been enlarged to include a section on entomology in which the authors describe briefly the general characters of Arthropods, outline their importance from the veterinary point of view and give very short notes on the morphology and bionomics of those species of flies, lice, ticks and mites that are injurious to domestic animals.

MACKAY (R.). Second (Final) Report of the Malaria Unit, Dar es Salaam, for the Period November 1934 to December 1936.—
Fol. 61 pp., 6 pls., 11 charts, 2 maps, 4 diagrs., 11 refs. Dar es Salaam, 1938. Price 5s.

In this final report on malaria and its control in Dar es Salaam, the author gives a summary of his work up to January 1934, the results of which were published in his first report [R.A.E., B 23 234], discusses the investigations carried out up to the end of 1936, and describes the control measures that are being or will be undertaken as a result of the survey.

The information obtained on Anophelines largely amplifies and confirms the previous findings [*loc. cit.*]. *Anopheles nili*, Theo., is added to the list of Anophelines taken. Only *A. gambiae*, Giles, and *A. funestus*, Giles, have been found infected with malaria. Dissections during the three years 1934–36 of 18,511 females of the former and

19,055 of the latter, gave oöcyst indices of 2.155 and 0.834 per cent. and sporozoite indices of 3.463 and 2.760 per cent., respectively. It appears, therefore, that *A. funestus* is, locally, as important a vector as *A. gambiae*. Of the other species, only *A. coustani*, Lav. (*mauritianus*, Grp.) and *A. gambiae* var. *melas*, Theo., have been found in houses in any numbers. Malaria is transmitted throughout the year almost without intermission, the rate of infection in *A. gambiae* decreasing as that of *A. funestus* increases. The breeding of both species is perennial, owing to the extent of the suitable breeding places in the numerous creeks. The conditions of hydrogen-ion concentration and of salinity in which the two species thrive are similar. Of 1,270 collections of water containing Anopheline larvae, most had a pH value of 7.6-8.0. About 52 per cent. of both species occurred in water containing under 10 parts per 100,000 and the rest in water containing up to 400 parts per 100,000.

An outline of the scheme for large-scale filling and draining is given, with the estimated costs. It is suggested that in addition to these projects for controlling Anopheline breeding, an attempt should be made to provide a protective zone of about one mile between the limit of the main populated area and extensive outlying breeding grounds by preventing indiscriminate building in the uncontrolled areas on the outskirts of the town, for the inhabitants of such dwellings provide a permanent reservoir of infection for Anophelines breeding in the vicinity, and thus intensify the degree of infection of those living on the periphery of the controlled area. The danger of man-made breeding places is emphasised, and suggestions for their elimination are made. The results of comparative tests with various larvicides showed that proprietary preparations, such as Shell Anti-Malarial oil, are the best. Shading of breeding places is of little value, as it does not control the breeding of *A. funestus*. The addition of chopped prickly pear, sisal leaves or even rice husks to breeding waters has been found effective both in the laboratory and in the field, particularly in stagnant water. Fish are the most important natural enemies of mosquito larvae, and there are at least two local larvivorous species, *Gobius criniger* and *Tilapia nilotica*; a local species of prawn has also been found to be extremely voracious. An effective insecticide for use against adult mosquitos is prepared by extracting 1 lb. flowers of pyrethrum (which is now grown in Kenya and is therefore sufficiently cheap to be used economically) in 1 gal. kerosene for not less than 24 hours, with frequent shakings.

Certain of the appendices contain information of entomological interest. Appendix 1 gives detailed findings on the Anophelines dissected. An area lying on the opposite side of the harbour entrance had long been suspected of being a supplementary source of malaria infection, particularly for the residential part of the town, when climatic conditions were favourable for breeding and dispersion. The experiments confirming this belief and the measures proposed for controlling breeding in the area concerned are dealt with in Appendix 2. Experiments in which the mosquitos liberated were sprayed with dye were unsuccessful, but those in which the mosquitos had fed on lint soaked in honey to which the same strong dyes (brilliant green and carbol fuchsin) had been added in small quantities were successful, 9 out of 800 of the mosquitos being recovered. The dye ingested was dissolved out of their thoracic tissues and stomachs with chloroform and glycerine.

LAVERGNE (J.). Présence à Madagascar de deux espèces anophéliennes africaines (*A. rufipes* et *A. splendidus*).—Bull. Soc. Path. exot.
31 no. 8 pp. 730-732, 2 refs. Paris, 1938.

In addition to those species of Anophelinae that have already been taken in Madagascar, namely, *Anopheles coustani*, Lav. (*mauritianus*, Grp.), *A. funestus*, Giles, *A. funestus* var. *imerinensis*, Monier & Treillard, *A. gambiae*, Giles, *A. squamosus*, Theo., *A. pharoensis*, Theo., and *A. maculipalpis*, Giles, the author records *A. rufipes*, Gough, and *A. splendidus*, Koidz., of which he describes the distinguishing characters.

In discussing the paper, M. Treillard points out the variability of the most important character distinguishing *A. splendidus* from *A. maculipalpis*, and suggests that the identification of Lavergne's examples is doubtful.

TOUMANOFF (C.). Au sujet de l'asthénie observée chez les femelles de *A. hyrcanus* var. *sinensis* du Tonkin pendant la période hivernale, et de ses conséquences probables dans la transmission du paludisme.—Bull. Soc. Path. exot. 31 no. 8 pp. 733-736, 2 refs. Paris, 1938.

To determine the behaviour of *Anopheles hyrcanus* var. *sinensis*, Wied., in winter in Hanoi, females were reared from larvae collected in nature about 20th October. They were offered a blood meal on a human arm every other day, and though they always fed, in only about one-third of the cases were the meals completed. About 25 per cent. oviposited after an interval of 12-34 days, about 5 per cent. after 73 days and about 70 per cent. after 104-125 days. In May, reared females oviposited in 9 days; 20 days after the beginning of the experiment, most of the females had oviposited or their ovaries were in the fifth stage. Larvae taken in nature at the same time may belong to different generations, and it is possible, therefore, that the females reared belonged to two generations, of which one was affected by asthenobiosis [cf. R.A.E., B 14 123] and the other was not; this would explain the differences observed in the pre-oviposition periods. Since, in the laboratory at Hanoi, the temperature in winter fluctuates considerably (the range may be as great as 11°C.) the mosquitos are periodically reactivated, but since their ovaries do not develop rapidly, it would appear that the retardation is not dependant on temperature alone. Moreover, it is not accompanied by the development of fat-body. No such marked retardation was observed in winter in reared females of *A. vagus*, Dönn., or in various Culicinae. The author suggests that this phenomenon may promote a closer contact between this species and man during the winter, as is the case with *A. maculipennis*, Mg., race *atroparvus*, van Thiel, and that it may therefore be responsible to a greater extent than other species for the transmission of malaria at this season.

LANDAUER (E.). Rapport sur la peste dans l'Ile de Hainan.—Bull. Soc. Path. exot. 31 no. 8 pp. 752-760. Paris, 1938.

After giving an account of the history of plague on the island of Hainan, the author comments on data connected with outbreaks of plague that occurred in certain towns there in 1937, collected in the course of a short visit in April and May. These include the results of the examination of 20 rats, chiefly *Mus* (*Rattus*)

norvegicus, which revealed 48 examples of *Xenopsylla cheopis*, Roths., 4 of *Pulex irritans*, L., and 3 of *Leptopsylla segnis*, Schönh. (*musculi*, Dug.). It appears probable that *X. cheopis* is the important vector of plague, but since almost every house harboured large numbers of *P. irritans*, it is possible that this flea is also concerned in transmission.

BRUG (S. L.). **Malaria en Muskieten.**—*Ned. Tijdschr. Geneesk.* **82** no. 28 pp. 3517–3518. Amsterdam, 1938.

In view of the report that full development of malaria parasites has been observed in *Culex bitaeniorhynchus*, Giles [R.A.E., B **25** 253], the author reviews some of the literature to ascertain how far Anophelines may be regarded as the exclusive vectors of malaria. He concludes that it is desirable to investigate the capacity for transmission of at least those Culicines that attack man.

POYNTON (J. O.) & HODGKIN (E. P.). **Endemic Filariasis in the Federated Malay States.**—*Bull. Inst. med. Res. F.M.S.* no. 1 of 1938, 67 pp., 1 col. pl., 22 figs., 23 refs. Kuala Lumpur, 1938.

In this bulletin, the authors summarise the facts connected with filariasis observed by other workers, particularly those pertinent to the disease as it exists in Malaya, and give the results of a preliminary survey of infested areas in Malaya. Much of the information of entomological interest has already been noticed [cf. R.A.E., B **26** 19; **27** 11]. Among the measures of control suggested for *Filaria (Microfilaria) malayi* is the reduction of the chances of contact between mosquitos of the genus *Mansonia* (*Mansonoides*) and persons infected with the parasite. This may be accomplished by removing all persons with positive blood films, or at least those with blood films showing large numbers of microfilariae, to an area where transmission does not occur; moving villages or estate lines to a point beyond the flight range of the vectors from their breeding places, mosquito-proofing buildings, and by using mosquito nets. The routine of labourers should be arranged so that they do not reach areas near swamps until after sunrise, since it has been found that rubber tappers and others that frequently go out in the early morning while it is still dark to areas near the large swamps that are the favourite breeding places of species of *Mansonia* are frequently bitten by large numbers of these mosquitos. In the case of *F. bancrofti*, measures aimed directly at eliminating the breeding places of the principal vector, *Culex fatigans*, Wied., may be advisable, whereas the control of *Mansonia* by such means would probably entail the drainage, selective weeding, or bringing into cultivation of large areas, and in many cases this would be economically impracticable.

In an appendix, notes are given on the morphology and bionomics of the five common Malayan species of *Mansonoides* and on methods of collecting and rearing them. The characters distinguishing the adults are shown in a table. The results of dissections of mosquitos that had fed on persons infected with *F. malayi* and of those caught in human-baited traps are shown in another appendix.

MACLEOD (J.). **The Tick Problem.**—*Vet. Rec.* **50** no. 39 pp. 1245–1250, 3 figs., 8 refs. London, 1938.

The density and distribution of the tick, *Ixodes ricinus*, L., is discussed, and it is pointed out that there are no grounds for believing

that during recent years there has been any increase in density over Great Britain as a whole. Although all the relations existing between the tick and its environment are not yet understood, enough has been discovered to make it reasonably certain that the factor limiting the successful spread of ticks is essentially physical. Spread as a continuous natural process takes place by means of host migration, and this, except in the case of certain predacious birds, rarely exceeds a few miles. Thus, spread will usually be into areas contiguous to those already infested. The establishment of infestation in isolated areas several miles from infested ground is unlikely, even if conditions are suitable for the survival of imported ticks, for two separated favourable areas are rarely included in the normal range of a single host. Discontinuous spread through droving or transport of sheep, or migrations of wild-life may occur, and the dispersed ticks may survive if conditions are suitable, but the chances of multiplication in such areas are small, for hosts passing over them remove ticks without leaving any engorged individuals in their place, so that the initial concentration is dissipated over a progressively wider area and the chances of the sexes meeting is correspondingly decreased. The factors limiting survival are discussed, and it is pointed out that of these, humidity is the most important. The moisture requirements of the tick are unusually high. Except during periods of low winter temperatures, neither unfed nor engorged ticks survive for more than a few days under ordinary air conditions in Britain, and during the summer months they require an almost saturated atmosphere. Microclimates fulfilling the necessary moisture conditions are found only in certain types of vegetation, namely a deep or matted layer of vegetation over acid soils in which the soil-water level remains near the surface throughout the summer. Such conditions are characteristic of rough grazing land on hills, and are seldom encountered in cultivated areas.

It is reasonable to suppose that in regions where ticks have long been established, they will have spread in the course of years over the whole of any continuous favourable area. It follows, therefore, that any recent extension of such tick-infested areas must be due to a change in conditions, such as the development of the vegetation towards a heath or moor type. Since the depression in agriculture began, many pastures have been allowed gradually to deteriorate, and where such pastures are within the range of tick-infested animals, the survival of introduced ticks has correspondingly risen from zero to 100 per cent. The immediate remedies are the introduction of mixed grazing to prevent the same tufts of grass being rejected year after year, severe harrowing to tear up the moss, liming to counteract the souring of the soil, reduction of cover for the ticks by burning or cutting, and, until the area has been restored to its original state, the prevention of the introduction of fresh ticks by dipping all sheep before they are allowed to graze in the area.

Heavy tick infestation of hosts other than sheep has led to the belief that the removal of such hosts will considerably reduce the numbers of the tick. This is probably true of such hosts as hares, which overrun moors and may be the principal means of sustaining the tick population, but the facts of each host-relationship should be investigated carefully before the principle is applied. In this connection, the author discusses at length the proposal to exterminate the native red deer. Infestation of deer is regarded as important only from the point of view of the danger of their maintaining ticks on grouse

moors or bringing ticks on to sheep grazings. On grouse moors, the part played by deer, compared with that played by grouse, hares and vermin, is unimportant on account of their relatively low density and their habit of using the same resting places, so that their ticks become concentrated in their lairs. They are also an unimportant factor in distributing ticks, since they remain on the high ground during the season of tick activity, and it is only in severe or wintry weather, when the degree of tick-infestation is at its lowest, that they enter cultivated areas, and then only for short periods. Thus, where deer and grouse occur together on tick-infested moors, the removal of the deer cannot be expected to alter materially the level of the tick population, and on sheep moors and cultivated areas the effect of their extermination would be even more negligible. This argument is supported by the fact that in Northumberland and on the Scottish Borders, where there are no deer, the tick population is higher than in the Scottish Highlands, over which the deer roam at will.

DIAS (E.) & TORREALBA (J. F.). *Infecção natural do Eutriatoma maculata pelo Schizotrypanum cruzi, no Brasil e na Venezuela.* [The natural Infection of *E. maculata* by *Trypanosoma cruzi* in Brazil and Venezuela.]—*Mem. Inst. Osw. Cruz* **33** pt. 2 pp. 249–252, 1 pl., 10 refs. Rio de Janeiro, 1938.

Eutriatoma maculata, Erichs., which has been recorded from Brazil, Venezuela and British Guiana, was found in nature in Brazil and Venezuela to be infected with *Trypanosoma (Schizotrypanum) cruzi*.

DE BEAUREPAIRE ARAGÃO (H.). *Nota sobre os Ixodideos da Republica Argentina.* [A Note on the Ixodids of Argentina.]—*Mem. Inst. Osw. Cruz* **33** pt. 2 pp. 319–327, 3 pp. refs. Rio de Janeiro, 1938. (With a Summary in English.)

Further identifications of ticks collected in Argentina showed that in addition to the 23 species already recorded [*cf. R.A.E.*, B **24** 89] four more occur, including *Ixodes ricinus*, L. Notes are given on the hosts, synonymy and local distribution of some of those recorded.

LE ROUX (P. L.). *Annual Report of the Veterinary Research Officer 1937.*—*Rep. vet. Dep. N. Rhod.* 1937 pp. 35–70. Lusaka, 1938.

In the section on entomology (pp. 66–67), the author states that ticks were more prevalent during 1937 than they were during 1936, and he attributes this increase to the fact that the pastures of the Mazabuka Research Station were not burned in these two years and that stock was dipped at fortnightly intervals during the cooler months of the year [*cf. R.A.E.*, B **26** 58]. Clipping the brushes of all cattle, including calves, infested with the bont-legged tick [*Hyalomma impressum*, Koch] gave satisfactory results at the Station, and farmers have been advised to adopt this practice, which has also been found to check the prevalence and spread of lice. In the case of valuable animals it is advisable to clip the whole tail relatively free from all long hair. The animals do not appear to suffer any discomfort and are relieved of the irritation caused by the presence of clusters of ticks.

OLIN (G.). **Une nouvelle épidémie de tularémie en Suède.**—*Bull. Off. int. Hyg. publ.* **30** no. 10 pp. 2230-2246, 16 refs. Paris, 1938.

An account is given of an outbreak of tularaemia in man in Sweden comprising 115 cases that occurred between the end of July and the beginning of October 1937, and the question of an insect vector is discussed. It appears unlikely that ticks are concerned, since their bites would not have escaped notice [cf. *R.A.E.*, B **24** 99]. The most probable vectors are *Chrysops discalis*, Will., or mosquitos. The period of activity of the former is earlier in the summer than that during which most of the cases occurred, so that it is unlikely to have played an important part in transmission, although two persons stated that they had been bitten by this fly on the spot at which the primary lesion later appeared. On the other hand, a number of the infected persons stated that while working out of doors several days before the onset of the disease, they had been attacked by mosquitos, which were both numerous and aggressive. Weather did not permit examination of mosquitos or experiments with them. According to reports, an outbreak of disease caused a high mortality among hares in localities south of the main focus of tularaemia in man, and occurred to a less extent in districts where fewer cases were observed. Three cases appear to have been contracted by handling an infected hare, and another by contact with rats. Mosquitos are active from the first days of summer, and they probably played a large part in the development of the epizootic that preceded the epidemic. The rapid diminution in the number of cases that occurred in the middle of September coincides with the end of the mosquito season, and the fact that several cases occurred in October was probably due to the continued presence of a few mosquitos, owing to the particularly warm autumn of 1937. Another factor in favour of insect transmission is that in only three instances did more than one case occur in a single family, and the interval that elapsed between the cases in these families ruled out contagion in all but two of them. A comparison of the epidemics of tularaemia that occurred in Sweden in 1931, 1934 [cf. *loc. cit.*] and 1937, including only those cases in which insect transmission was probable, shows that their seasonal distribution was similar. A study of the position of the primary lesion in 97 cases also suggests insect transmission. It occurred most frequently on the lower extremities, particularly in women and children; this is undoubtedly because the women frequently wear no stockings during the summer. In the other cases, lesions occurred on the forearm, the elbow or the face. The apparent periodicity of the epidemics in Sweden is probably related to the time necessary to build up a normal population of small game animals after an epizootic has reduced their numbers.

KAMITO (N.). **Poisonous Action of *Euproctis flava* Bremer (Preliminary Report).** [In Japanese.]—*Trans. nat. Hist. Soc. Formosa* **28** pp. 407-413. Taihoku, Formosa, 1938.

Descriptions are given of the urticating scales and hairs on the bodies of adults of *Euproctis flava*, Brem., which sometimes occurs in large numbers in Korea.

EICHLER (W.). **Deutsche Vogelflöße und ihre Lebensweise.** [German Bird Fleas and their Habits.]—*J. Ornith.* **86** pt. 4 pp. 544–549, 17 refs. Berlin, 1938.

The distribution of such permanent parasites of warm-blooded animals as lice depends less on geographical factors than on the racial relationships of the hosts, whereas temporary parasites, such as fleas, are limited by the biology of the hosts. A list is given of the 14 species of fleas that have been recorded from birds in Germany.

PAPERS NOTICED BY TITLE ONLY.

LÓPEZ-NEYRA (C. R.) & MIRA (A. G.). **Protofitos parasitos de los mosquitos y sus larvas en España.** [A survey of the literature on fungous parasites of mosquitos and their larvae in Spain and elsewhere.]—*Bol. Univ. Granada* **10** no. 47 pp. 105–114, 15 refs. Granada, 1938.

DE BUCK (A.). **Das Exochorion der Stegomyia-Eier.** [The Exochorion of the Eggs of *Aëdes (Stegomyia) aegypti*, L., and *A. (S.) albopictus*, Skuse.]—*Proc. K. Akad. Wet.* **41** no. 6 pp. 677–683, 1 pl., 8 figs., 7 refs. Amsterdam, 1938.

INABA (S.). **On the Salinity Tolerance of the Larva and Pupa of the Mosquito (*Ochlerotatus* sp.).** [In Japanese.]—*Kontyû* **12** no. 6 pp. 216–219. Tokyo, December 1938.

HOFFMANN (C. C.). **La distribución geográfica de los “Alacranes peligrosos” en la República Mexicana.** [The geographical Distribution of dangerous Scorpions in Mexico.]—*Bol. Inst. Hig. Mex.* **2** no. 6 pp. 321–330, 1 map, 3 refs. Mexico, D.F., December 1936. [Recd. December 1938.]

[MIRZAYAN (A. A.).] **Мирзаян (А. А.). Contribution au problème des stades de la digestion chez le *Ph. papatasii* Scop.** [In Russian.]—*Med. Parasitol.* **7** no. 4 pp. 606–609, 4 figs. Moscow, 1938. [Cf. R.A.E., B **26** 64.]

THOMPSON (G. B.). **An Ectoparasite Census of some common Javanese Rats** [sucking-lice, mites and fleas from *Mus rattus diardii*].—*J. Anim. Ecol.* **7** no. 2 pp. 328–332, 1 pl., 6 refs. London, 1938.

WHITTICK (R. J.). **On a new Tick [*Ornithodoros delanoëi acinus*, subsp. n.] from British Somaliland.**—*Parasitology* **30** no. 3 pp. 333–338, 7 figs., 2 refs. London, 1938.

SRIVASTAVA (Har Dayal). **The Occurrence of an Unrecorded Filarid Nematode, *Onchocerca cervicalis* Railliet and Henry, 1910, in the Ligamentum nuchae of Horses in India.**—*Indian J. vet. Sci.* **8** pt. 3 pp. 249–250, 4 refs. Delhi, 1938. [Cf. R.A.E., B **22** 58.]

FARINAUD (M. E.). **La prophylaxie du paludisme dans les troupes en campagne** [in Indo-China. A general discussion].—*Ann. Méd. Pharm. colon.* **36** no. 3 pp. 583–608. Paris, 1938.

LESTER (H. M. O.). The Progress of Sleeping Sickness Work in Northern Nigeria.—*W. Afr. med. J.* **10** no. 1 pp. 2–10, 1 map. Lagos, 1938.

An account is given of the distribution of sleeping sickness in man in the Northern Provinces of Nigeria, the character of the disease, the reasons for its spread in recent years and the measures that are being taken for its control. A scheme for the expansion of the sleeping sickness service, which was put into operation in April 1937, includes the provision of staff to advise on protective clearings and to supervise the communal labour in carrying out such work, and of staff and funds to organize and carry out the concentration of population in certain districts, both of which measures are being undertaken with a view to reducing the contact between man and *Glossina*.

NASH (T. A. M.). The Probable Effect of Densification of Woodland upon the Distribution of Tsetse in Northern Nigeria.—*W. Afr. med. J.* **10** no. 1 pp. 10–13, 6 refs. Lagos, 1938.

It is well known that the conservation of moisture by the soil is enormously reduced by the destruction of forests and that serious erosion is likely to take place when the natural covering of woodland is destroyed; it is, therefore, the aim of the Nigerian Forest Department to keep approximately 25 per cent. of each district under woodland. In East Africa, it has been found that the thickening that takes place in certain vegetation communities from which fire is excluded is accompanied by a steady decrease in the population of certain species of *Glossina* [cf. *R.A.E.*, B **22** 234], and it might be assumed that a policy of densification would have a similar effect in Nigeria. Unfortunately, the climate of Nigeria is so much more severe that a greater density of the vegetation is the condition needed by the fly to protect it from adverse climatic conditions and so enable it to extend its range. The author illustrates this by comparing the habitats of *G. morsitans*, Westw., in East and West Africa and giving the reasons for their differences [cf. **25** 161]. He also discusses the habitats of *G. tachinoides*, Westw., and *G. palpalis*, R.-D., in Northern Nigeria in relation to the policy of the Forestry Department. The former depends on riverine vegetation and care should be taken that fuel plantations and forestry reserves are not situated near streams in the vicinity of towns, since, even if the stream itself is almost devoid of vegetation where it flows through cultivation, once its banks have been planted, it can readily be colonised by roving flies which spread along it during the wet season; these flies may then migrate away from the stream through plantations or reserves and so be brought much nearer to towns.

The author has not carried out research on the optimum climatic conditions for *G. palpalis*, but there are indications that in the southern parts of northern Nigeria, a policy of densification of woodlands might have an unfavourable effect on it, since it has been found in one locality that where patches of riverine bush are exceedingly dense and have been left undisturbed by man it is very scarce, but that where clearings have been made it is numerous. In this district, the natural forest was so dense that the fly was probably unable to find its prey and flight was exceedingly difficult, whereas in places where ginger farmers had cleared the undergrowth and left the huge forest trees standing, ideal shady feeding grounds were produced, and the fly could shelter in the

uncleared margins and dart out into the shady farms to feed on the cultivators. In southern Nigeria the interior of the great forests is free from *G. palpalis*, but the fly occurs where lanes are cut by rivers or man.

It is therefore concluded that a large-scale densification of woodland in Northern Nigeria by fire exclusion would enable all three species to extend their range. Wherever possible, forestry reserves from which fire is to be excluded should be situated in uninhabited areas where *G. morsitans* does not occur. In the vicinity of towns, it is advisable to clear all streams within forest reserves and to make no attempts to exclude fire, to place all fuel plantations in areas between streams, and if possible, to allow a distance of a quarter of a mile between their boundaries and any stream. Densification could only succeed in the southern parts of Nigeria where a cooler, moister climate makes the fly prefer more open conditions and the high rainfall tends to produce excessively dense vegetation.

SYMES (C. B.) & SOUTHBY (R.). The Reduction of *G. palpalis* in a Lake Shore Area by the "Block" Method.—Fol. 4+32 pp., 4 fldg diagrs., 1 map, 22 photographs, 3 refs. Nairobi, 1938.

A detailed account is given of an experiment carried out between March 1935 and September 1937 in which an attempt was made to eliminate *Glossina palpalis*, R.-D., from an area along the shore of Lake Victoria in Kenya Colony by the "block" method, which had been used successfully along infested rivers [R.A.E., B 25 165]. Brief notes are given on the topography, vegetation, climate and fauna of the area, and on the incidence of sleeping sickness and the habits of the population. Descriptions of the 6 clearings include their locations, dimensions, the type of original bush that had to be cleared, the cost and progress of clearing, and their present state. The technique used for reducing the fly is outlined, and descriptions are given of each block, together with the details of the measures carried out and the results obtained. Points of interest relating to trapping, to the bionomics of *G. palpalis*, and of *G. pallidipes*, Aust., and *G. brevipalpis*, Newst., the two other species of tsetse fly found in the area, and to the recovery of the fly population after reduction by collection of adults and pupae are discussed.

The following is taken from the authors' summary and conclusions : A total area of 713 acres was cleared at a cost of approximately £900. The amount of clearing was about twice as much as that necessary for isolating the infested blocks of bush, the extra clearing being undertaken to facilitate early settlement and agricultural production. Fly reduction was accomplished by hand-catching of adults, collection of pupae, and trapping ; the first method was the most economical, the second was much more costly, and the last was ineffective. The decrease brought about in the numbers of *G. palpalis* on the mainland varied between approximately 50 and 90 per cent. ; the small fly population on Hanete Island was practically eliminated in 3½ months. The total cost of fly reduction measures, excluding the nominal value of traps, was approximately £878. Data collected indicate that *G. palpalis* can maintain itself at a low density by breeding in sugar-cane and banana plantations. Its pupal period in the area concerned lasts 43–53 days. The season of its maximum activity is from April to June and that of maximum reproduction from April to September.

Considerable movement of fly occurs along the shore and between the mainland and islands, and although this is aided by pedestrian and canoe traffic, large numbers of flies cross stretches of open water as much as 400 yards wide. The periods of maximum adult activity and maximum reproduction in *G. pallidipes* and *G. brevipalpis* occur at the same time as those of *G. palpalis*. Settlement and development have progressed satisfactorily. Elimination was not achieved, but the reduction accomplished and the experience gained indicate that, even with high densities of fly, hand-catching can be employed successfully and economically. It is hoped that the eradication of *G. palpalis* in this area will be completed in the near future.

STEWART (J. L.). Tsetse-fly Eradication.—*Rep. Dep. Anim. Hlth Gold Cst 1937-38* pp. 14-17. Accra, 1938.

Details are given of clearing work against tsetse flies in various parts of the Gold Coast during the year ending March 1938. Only 62 examples of *Glossina tachinoides*, Westw., were caught in the area surrounding the Veterinary Station at Pong-Tamale during the rains of 1937 [cf. *R.A.E.*, B 25 221]; further clearing along the river Naboggo was carried out. No examples of *G. palpalis* were taken in this area during the year. There was a great diminution in the numbers of fly taken during the dry season in the uncleared parts of the river, but the cause of this is not known. Only small numbers of fly were caught in the plantation at Yendi [cf. 26 45], and, as a result of further drastic clearing, it is hoped that this focus has been eliminated.

In a survey during the wet season, it was found that *G. palpalis* had penetrated into the environs of Accra town and established itself in a valley leading to the sea; it was abundant up to the town boundary and even penetrated the town itself. A system of field drainage round Accra, together with the removal of scrub and the trimming of trees, is recommended. Large numbers of *G. palpalis* were again found at Kumasi in August, in spite of the large clearings.

HENDERSON (G. T.). Veterinary and Livestock Division.—*Rep. Dep. Agric. Basutoland 1936-37* pp. 38-70. [Maseru, 1938.]

In the section on ectoparasites (pp. 61-62), the following are mentioned as parasites of small stock in Basutoland: *Oestrus ovis*, L., which is abundant and causes mortality among sheep, particularly in the lowlands, *Melophagus ovinus*, L., which is numerous in certain localities, *Ixodes rubicundus*, Neum. (paralysis tick), which causes mortality in the autumn in the lowlands, *Linognathus stenopsis*, Burm. (*africanus*, Kellogg & Paine), which is found on sheep, and *Bovicola caprae*, Gurlt., which is prevalent on goats. Although all the blowflies found in South Africa are present, they do not appear to menace the sheep industry. *Stomoxys calcitrans*, L., causes mortality after shearing, particularly in the lowlands during wet seasons.

ROE (R. J.). Annual Report of the Veterinary Service for the Year 1937.—*Rep. Dep. Agric. Cyprus 1937* pp. 22-30. Nicosia, 1938.

The ox-warble flies, *Hypoderma bovis*, DeG., and *H. lineatum*, Vill., are prevalent in Cyprus. A preliminary study in a group of villages

south of Famagusta during the early months of 1937 showed that infestation of cattle is very heavy, considerable damage is caused to hides and meat, and agricultural operations are impeded owing to the frequent impossibility of using cattle for ploughing, etc., when the flies are on the wing. The warbles occur during the period from December to April. Dressing them with a derris preparation was found to be a cheap and effective means of destroying the larvae. Arrangements were made to treat large numbers of cattle in different parts of the Colony during the period from December 1937 to April 1938 in order to obtain more complete information and to demonstrate the value of the method before introducing compulsory treatment throughout the island. *H. aeratum*, Aust., which attacks goats and occasionally sheep, is very prevalent in many parts of the island and is responsible for serious damage to kid skins. In an area where infestation was particularly severe, warbles were contiguous over the entire back, loins and other parts of the body of kids one year old, numerous abscesses were formed and many of the animals died of septicaemia. Treatment with derris preparations gave satisfactory results.

BRUCE (W. G.). Soil Moisture and its Relation to the Mortality of *Hypoderma Pupae*.—*J. econ. Ent.* **31** no. 6 pp. 639–642, 2 figs., 10 refs. Menasha, Wis., 1938.

Hypoderma bovis, DeG., and *H. lineatum*, Vill., are found throughout the United States, but there are certain areas where they are scarce or periodically absent. Most of these areas are small and scattered, but there is one large area, the Red River valley in the Dakotas and Minnesota, from which, under average climatic conditions, they are entirely absent. This area, which is described, was studied in 1929–1933, and it was concluded that the dominant factor responsible for the scarcity of *Hypoderma* is excessive soil moisture. The predominating soil type is a clay that has little surface or subsurface drainage, and during periods of heavy rainfall it becomes saturated and remains wet for long periods. In central and western North Dakota, warbles are found in the backs of cattle from the latter part of February until early in June, larvae of *H. lineatum* first appearing in February and those of *H. bovis* in the latter part of March. At the time the larvae drop from the backs of cattle, the ground is frozen or the soil is very wet, and the investigations showed that larvae that dropped on saturated soil failed to pupate and subsequently died. The pupal period lasts from 17 to 38 days. Under normal conditions, the accumulation of rain, sleet and snow provides sufficient moisture to saturate the soil of the valley, which is kept moist by the spring rains until after the period of emergence of the adults. Field and laboratory experiments showed that although pupae did not develop in wet soils, they developed in the same soils when they were adequately drained.

The laboratory experiments described were carried out at Ames, Iowa, during 1933–34, to determine the behaviour of *Hypoderma* pupae in soils of known moisture content. The results show that pupae will not mature in soils having a moisture content of more than 22 per cent. The exact minimum of moisture content that produces mortality has not been ascertained, but it probably varies with the type of soil and is possibly not in excess of the hygroscopic coefficient,

SPICER (W. J.) & DOVE (W. E.). **The Screw-worm and the Gulf Coast Tick in Southern Texas.**—*J. econ. Ent.* **31** no. 6 pp. 642-646, 1 ref. Menasha, Wis., 1938.

The incidence of infestation of domestic animals by *Cochliomyia hominivorax*, Coq. (*americana*, Cush. & Patt.) in Texas, particularly the southern counties, in 1936 and 1937 is given in detail, special attention being paid to infestations of injuries caused by the bites of the tick, *Amblyomma maculatum*, Koch [cf. *R.A.E.*, B **25** 82, etc.]. The reduction of the average rate of infestation in 1937 (392 per 100,000 animals) to about half that in 1936 (825) was attributed partly to control measures and partly to the dry weather in the southern counties. The fall in the average rate of infestation in 1937 was not so great in the southern counties along the coast as in those inland, a fact indicating that the drought was less effective in controlling the fly in the former. In 1936, 9.69 per cent. of the total number of cases were attributed to tick bites, and these were restricted to an area within about 100 miles of the coast [cf. **25** 80]. Approximately 60 per cent. of them occurred in 13 adjoining counties on the south coast during the four months July-October and constituted 57.8 per cent. of the total number of cases reported from these counties. The marked reduction in the number of cases of infestation in tick-bite injuries in 1937 is attributed largely to the treatment of the ears of animals. Treatment when the tick first appears is advised, since if application is delayed until fly infestation has taken place, it is more difficult because the ears have become sensitive. A mixture consisting of 1 qt. cotton-seed or linseed oil and 3 qts. pine-tar oil is recommended for use on the ears. If 1 pint benzol is added to each gallon of the mixture, it will kill ticks in a shorter period of time, will aid in killing small screw-worm maggots and will ensure a more even spread on the skin.

BRENNAN (J. M.). **The Incidence and Importance of *Cochliomyia americana* and other Wound-invading Species.**—*J. econ. Ent.* **31** no. 6 pp. 646-649, 4 refs. Menasha, Wis., 1938.

From March 1936 to September 1937, the author identified approximately 35,000 specimens of larvae in more than 2,500 lots taken from wounds in living animals (chiefly domestic stock) throughout the area of the United States infested by *Cochliomyia hominivorax*, Coq. (*americana*, Cush. & Patt.). Each lot came from a single case and in most instances from a different locality. The number of infestations by different species is given in tables, first according to the states from which the collections were made and then according to the species of animal infested. The data show that *C. hominivorax* was responsible for 86 per cent. of the infestations and secondary species for the remaining 14 per cent., thus confirming the finding that *C. hominivorax* is the species chiefly concerned [cf. *R.A.E.*, B **26** 44]. *Phormia regina*, Mg., was responsible for 62 per cent. of the infestations due to secondary species. Its activity in a wound frequently resembles that of *C. hominivorax* and, although it is generally considered to be a winter species, it was active in many of the south-eastern states throughout the summer of 1936. Only 1 per cent. of the infestations were due to *C. macellaria*, F., and it seems likely that most of these had been initiated by *C. hominivorax*. Of the species of *Lucilia*, *L. sericata*, Mg., occurred most often; it is probably beneficial where it does not occur

in excessive numbers, because its activities tend to hasten the healing of wounds. The importance of the transportation of infested livestock in the distribution of *C. hominivorax* is confirmed [cf. 25 83].

TRAVIS (B. V.). The Fire Ant (*Solenopsis* spp.) as a Pest of Quail.—
J. econ. Ent. 31 no. 6 pp. 649–652, 5 refs. Menasha, Wis., 1938.

Fire-ants (*Solenopsis* spp., particularly *S. geminata*, F.) cause considerable injury to quail in the southern part of the United States. The greatest damage occurs during the hatching period, when the ants enter the egg as soon as the chick breaks it and consume the chick before it can escape from the shell. In many instances the ants harass the hen so much that it deserts the nest. In view of the losses caused by these ants and the difficulties encountered in their control on preserves in Georgia and Florida, an investigation was begun in the spring of 1935 to obtain information on their bionomics and on soil fumigants and poison baits for their control. The most interesting point observed was that 7 out of 12 colonies from which the mother queen was removed in the spring of 1937 were still active nearly a year later; they were producing young and appeared normal in all respects. All 12 colonies decreased in size for about three months, and 5 completely disappeared, though it is possible that they merely moved from their original sites. The colonies disappear and reappear within a certain area, giving no indication where they have gone or whence they have come. Normal colonies have long lateral tunnels through which the ants may migrate underground; in an extreme case a colony was found to have moved 117·5 ft., and the line of travel was visible in two places only for a total distance of 12 ft. Thus, it is extremely difficult to obtain accurate data on the results of control measures, for at the least disturbance the colony may move to a new site. Even a comparison of the apparent effectiveness of the methods used is difficult, since the results obtained with soil fumigants vary with such factors as the type of soil, time of year, etc. Of 553 colonies treated in 1936 with sodium cyanide dissolved in water (1 oz. to 1 U.S. gal. [cf. *R.A.E.*, B 26 112]), 34·2 per cent. showed signs of activity 3 months later; of 100 colonies treated in 1937 by placing a 1 oz. egg of sodium cyanide in a hole about 12 inches deep made in the centre of the colony mound, 53 per cent. were inactive 3 months later. In an attempt to eradicate the ants, one field of 3 acres received 16 treatments in 2 years and the other of 5 acres, 14 in 3 years. Small colonies of ants persisted on both plots. In view of the discouraging results obtained with soil fumigants, field tests were made with poison baits; the ants fed on most of the baits for a few moments and then refused to feed further. Preliminary tests with a number of different insecticides in the laboratory indicated that none was sufficiently effective for use in the field.

DEONIER (C. C.). Effects of some Common Poisons in Sucrose Solutions on the Chemoreceptors of the Housefly, *Musca domestica* L.—
J. econ. Ent. 31 no. 6 pp. 742–745, 6 refs. Menasha, Wis., 1938.

A repellent effect of various poisons used in baits for *Musca domestica*, L., has been reported. The purpose of the experiments described was to determine the repellent action of various non-volatile poisons on this fly by observing their effects on the normal movements

of the proboscis. It was found that chemoreceptors on its tarsal segments enable the fly to select the substances that will be touched by the proboscis [cf. R.A.E., B **14** 223; **24** 64]. The technique used in the experiments is described. Different concentrations of chemically pure mercury bichloride, sodium fluoride, sodium fluosilicate, arsenic acid and arsenious acid were tested in solutions containing enough granulated cane sugar to make a 1-molar concentration of sucrose. The criterion of response to tarsal stimulation was the extension of the proboscis, and where the concentration of the added substance prevented this, the substance was assumed to have a repellent effect on the chemoreceptors. A solution that stimulated the tarsal receptors might, however, produce a negative response in the receptors on the proboscis and cause its instant withdrawal. Whether the flies ingest the solution was also determined.

The following is taken largely from the author's summary : Tarsal receptors were stimulated by 1 M solutions containing 0·5 gm. per 100 cc. mercury bichloride, but proboscis responses were negative to concentrations of 0·05 per cent. or more. Concentrations of 0·025 per cent. or more adversely affected the feeding of the flies. These results indicate that concentrations greater than 0·01 per cent. should not be used in baits for house-flies. Concentrations of 3·5 per cent. sodium fluoride, 0·5 per cent. sodium fluosilicate, and 1·84 per cent. arsenious acid were not repellent and did not materially affect feeding. Arsenic acid was repellent at concentrations above 0·25 per cent. Contact with a 5 per cent. concentration of mercury bichloride so affected the chemoreceptors of the tarsi that they failed to stimulate proboscis responses in tests with sucrose solutions carried out immediately after ; gradual recovery took place in some of the flies, and 68 per cent. exhibited normal responses at the end of 5 hours.

PARISH (H. E.) & CUSHING (E. C.). Locations for Blowfly Traps : Abundance and Activity of Blowflies and other Flies in Menard County, Tex.—J. econ. Ent. **31 no. 6 pp. 750-763, 1 fig., 1 ref. Menasha, Wis., 1938.**

A detailed account is given of the results of an investigation from 1st April 1929 to 31st March 1933 to determine the comparative abundance and activity of blowflies, particularly species of *Cochliomyia* and *Phormia*, by the numbers caught in 10 traps situated in different types of surroundings in Menard County, Texas. Descriptions are given of the locality in general, the weather conditions during the four years and the situations of the traps. These were baited with 2 lb. lean beef in 1½ U.S. gals. water to which 6 cc. nicotine sulphate was added to prevent larvae from developing in the bait. Evaporation at the site of each trap was determined by a Livingston atmometer. The intervals at which the traps were emptied were 10 days from 1st April to 21st October, 20 days from 22nd October to 11th January, and 40 days from 12th January to 31st March. The amount of flies taken in each trap was determined by weight ; during the last season it was also determined by volume. A random sample of 500 flies was taken from each trap every time it was emptied, and these were identified, generically in the case of species of *Cochliomyia* and *Phormia* and specifically in the case of almost all other genera. When less than 500 flies were caught, all were identified. The number, species and percentage of each species of all flies taken in the samples

and the total amount of flies caught in each situation are shown in tables ; the data are discussed at some length. The difference between *Cochliomyia hominivorax*, Coq. (*americana*, CUSH. & PATT.) and *C. macellaria*, F., was established after this investigation was completed ; the proportion of the two species taken in traps is about 1 : 3,000. There was a progressive increase in the numbers of *Cochliomyia* during the four years. The abundance of *Phormia* is probably more closely related to seasonal weather conditions, and this no doubt accounts for the fluctuations in the numbers of these flies from year to year. There was a progressive decrease in the numbers of all species of Sarcophagids, but no marked progressive change in the numbers of the other species of flies. The density of shade, protection from wind, nearness to large ponds or running streams, dryness of the atmosphere, and, to some extent, the density of surrounding timber and underbrush appear to be the most important of the factors determining the numbers of the different species inhabiting a particular situation ; other factors, such as nearness to houses, barns, corrals and water tanks, and elevation, appear to be of minor importance. Proximity to collections of water appears to have little effect unless they are sufficiently extensive to influence markedly the relative humidity in their vicinity. The dryness of the atmosphere, as measured by water evaporation, undoubtedly affects the abundance and activity of flies, but the data indicate that species of *Cochliomyia* are least influenced by this factor. From a study of the situations of the traps that caught the largest amounts of flies and the highest percentages of species of *Cochliomyia* and *Phormia*, it is concluded that a trap placed in very light shade, near a running stream or large pond, protected from direct wind and surrounded with timber and underbrush of medium density should prove highly efficient in catching flies of these two genera.

CUSHING (E. C.) & PARISH (H. E.). Seasonal Variations in the Abundance of *Cochliomyia* spp., *Phormia* spp. and other Flies in Menard County, Tex.—*J. econ. Ent.* 31 no. 6 pp. 764-769, 1 fig., 1 ref. Menasha, Wis., 1938.

Data obtained in the course of the investigation described in the preceding paper are used in this paper for computing the seasonal prevalence of trapped flies. The weather conditions, topography and ranching practices, and the species and abundance of flies in the area under consideration are generally similar to those in the rest of the Edwards Plateau region of Texas. Some of the species are not usually attracted to blowfly traps, and in these cases the data do not indicate their actual abundance. Certain morphological variations have been noted in the females of the species usually considered to be *Phormia regina*, Mg. Whether such differences indicate a new species has not been determined, and in this paper *Phormia* spp. refer only to *P. regina* and to any other closely related species not yet described. The temperatures and evaporation, the weight of flies caught during the periods between the emptying of the traps (see preceding paper), the comparative abundance of each species or genus during the same periods, and the rainfall for 10-day periods are shown in tables, and the seasonal variation in rainfall and mean temperature and the relation of these factors to variations in the comparative abundance of species of *Phormia* and *Cochliomyia* are illustrated in a graph.

The data indicate that there are four main peaks in the comparative abundance of species of *Cochliomyia*, namely 10th–20th May, 9th–19th July, 7th–17th September and 17th October–6th November. There are few cases of infestation by these flies before 10th May, and operations on animals should be completed, and animals mated so that young are born, before this date. The best time for the autumn shearing of sheep and goats appears to be during the last 10 days of August or between 27th September and 17th October. Wool should be trimmed from the breech of sheep during the latter part of February or early in March to avoid the possibility of infestation by *Phormia*.

EAGLESON (C.). Resistance of *Stomoxys calcitrans* (L.) to Laboratory Application of Pyrethrum Spray.—*J. econ. Ent.* **31 no. 6 p. 778. Menasha, Wis., 1938.**

Tests with a pyrethrum spray (Official Control Insecticide [cf. R.A.E., B **27** 23]) against *Stomoxys calcitrans*, L., were carried out in a concrete vault in which 55·9 cc. of the insecticide was needed to produce a mortality of approximately 50 per cent. in *Musca domestica*, L. The amounts used were 5·6, 2·8 and 1·12 cc., all of which gave 100 per cent. mortality, and 0·56 cc., which gave 93 per cent. When 9·44 cc. of a refined kerosene was added to 0·56 cc. O.C.I., the mortality was 88 per cent.

LYLE (C.) & GLADNEY (H.). Gulf Coast Marsh Ditches that remain in good Condition without Maintenance.—*J. econ. Ent.* **31 no. 6 pp. 778–779. Menasha, Wis., 1938.**

Examination, more than four years after their construction, of ditches cut in the marshes along the coast of Mississippi and on the adjacent islands showed that there had been practically no deterioration, except in places where cattle had broken in the sides, and that mosquito breeding had been effectively prevented.

RENDTORFF (R. C.). A Method of Rearing the Bedbug, *Cimex lectularius* L., for Studies in Toxicology and Medical Entomology.—*J. econ. Ent.* **31 no. 6 p. 781, 1 fig. Menasha, Wis., 1938.**

The author points out that the use of *Cimex lectularius*, L., as a test insect has been neglected owing to the difficulties of rearing it. He therefore describes a method by means of which large numbers may be reared in a minimum amount of time with a low mortality. A device for holding the guineapig that is the source of food for the bugs is also described and illustrated.

AUGUSTINE (D. L.). Observations on the Occurrence of Heartworms, *Dirofilaria immitis* (Leidy, 1856), in New England Dogs.—*Amer. J. Hyg.* **28 no. 3 pp. 390–395, 10 refs. Lancaster, Pa., 1938.**

Examination of the blood of 94 dogs and 10 silver foxes in Massachusetts and 28 dogs in New Hampshire revealed that 8 dogs from Massachusetts were infected with *Filaria* (*Dirofilaria*) *immitis*. None of the dogs from New Hampshire and none of the foxes were infected. The parasite is apparently indigenous in eastern

Massachusetts. All of the species of North American mosquitos that have been shown experimentally to transmit the parasite [R.A.E., B 20 9; 26 210] have been recorded from New England, except *Aedes aegypti*, L., and *Culex territans*, Wlk.

HERTIG (M.). Notes on Peruvian Sandflies. Identification of Females of *Phlebotomus verrucarum* and *P. noguchii*.—Amer. J. Hyg. 28 no. 3 pp. 463–468, 1 pl., 4 refs. Lancaster, Pa, 1938.

The author describes various characters, chiefly of the head, by means of which it is possible to distinguish the females of *Phlebotomus verrucarum*, Tns., from those of *P. noguchii*, Shannon [cf. R.A.E., B 17 189]. He points out that it is not always safe to judge the species of the females by that of the males in the same place [cf. loc. cit.], since in a spot where the males of *P. noguchii* outnumbered those of *P. verrucarum* by 10 to 1, most of the few females taken were those of *P. verrucarum*. The differentiation of these two species has made it possible to note certain sharp differences in their occurrence and behaviour in the lower part of the verruga zone of the Rimac Valley. The observations do not include *P. peruvensis*, Shannon, which was only represented by one individual out of several thousand sandflies caught. They confirm Shannon's finding that *P. verrucarum* enters buildings freely and is the only species that does so; engorged females were common in all catches. It feeds readily on man and other mammals in the laboratory. Contrary to Shannon's experience, however, it was also, with rare exceptions, the only species taken in such places as pig pens and the sleeping places of dogs and guineapigs. On the other hand, *P. noguchii* was practically limited to excavations [cf. 26 60], and the relatively few females hardly ever contained blood. It refused to feed in the laboratory on man, other mammals, reptiles and amphibians. The principal hiding places of the engorged females and the hosts are, therefore, still to be discovered, and its relation to the transmission of verruga is an open question.

STEWART (M. A.) & MACKIE (D. B.). The Control of Sylvatic Plague Vectors.—Amer. J. Hyg. 28 no. 3 pp. 469–480, 14 refs. Lancaster, Pa, 1938.

Sylvatic plague has continued to spread despite the fact that efficient measures for the control of rodents have been in force in California for 30 years, and more recent studies have indicated that measures should also be directed against their fleas, since these act as pseudo-reservoirs as well as vectors of plague. The experiments described were undertaken to discover a fumigant that would be effective against both. Hydrocyanic acid gas has not given satisfactory results in the control of rodents, whereas methyl bromide has recently proved effective in this respect. The technique of the experiments is described. In all cases, the fleas after exposure to the gas were placed under optimum conditions for survival. In the laboratory experiments, the fleas used were *Ceratophyllus (Diamanus) montanus*, Baker, and *Hoplopsyllus anomalus*, Baker, and the rodents were *Citellus beecheyi douglasii* (from which these fleas were collected) or rats. In the field, all the burrows fumigated were those of *Citellus beecheyi fisheri* and all the fleas taken in them were *H. anomalus*.

In laboratory experiments in which a number of fumigants were tested against adult fleas, hydrocyanic acid gas and methyl bromide gave the most satisfactory results, and although the former was more effective against the fleas, the latter was used in all later experiments because of its greater toxicity to rodents and because hydrocyanic acid gas has been reported not to kill fleas in the side turnings of burrows or in the nests [R.A.E., B 25 118]. Complete mortality was obtained in half an hour with 0·5 cc. methyl bromide in a gaseous state in a chamber with a capacity of 126 cc. at temperatures of 72 and 76°F. It was calculated that this concentration could be produced by using 0·766 cc. of liquid methyl bromide in a chamber with a capacity of 1 cu. ft. in which experiments on living ground squirrels or rats heavily infested with fleas were carried out. Complete mortality of fleas was obtained in 30 minutes with this amount at temperatures of 55–64°F., and 99·8 per cent. mortality in 15 mins. with 0·5 cc. of the liquid at 62°F. Methyl bromide does not kill immediately, but neither does it excite rodents or fleas before stupefying them; in laboratory tests the fleas were dead 1–24 hours after exposure to the gas, the length of time depending on the concentration of the gas and the length of exposure. Eggs, larvae and pupae of fleas in litter were also killed by methyl bromide but proved more resistant than the adults.

In field tests in four areas with different soil conditions and atmospheric temperatures ranging from 30 to 110°F., 6–20 cc. liquid methyl bromide was introduced into each of the openings of the burrows, which were then plugged. After 10–24 hours, the burrows were opened carefully, and dead ground squirrels, nest materials and scrapings from the floors of the runways were examined for fleas. Enormous numbers were obtained, but no signs of life were observed in any of the stages at the time of collection, and in no case did revival or development take place later. All Arthropods other than fleas found in the fumigated burrows were dead at the time of collection. It is customary to use approximately 10 cc. methyl bromide for each opening of the burrows when destroying ground squirrels, and these results indicate that this amount is sufficient to kill fleas in all stages of development.

The toxicity of the fumigant to man is discussed, and it is concluded that although there is probably no greater risk for a trained operator in handling methyl bromide than any other colourless, odourless fumigant, constant care must be exercised not only because it is highly toxic, but also because there is no known antidote for it. The precautions to be observed are also discussed. It is suggested that cargoes of grain and similar products infested with plague-infected fleas might well be fumigated with methyl bromide to prevent the spread of the disease, since tests have shown that food materials so treated are not made toxic by absorption or adsorption of the fumigant, and a number of workers have reported favourably on its use against ordinary pests of grain [cf. R.A.E., A 26 388, 746, etc.].

CAUSEY (O. R.). Experimental Intestinal Myiasis.—*Amer. J. Hyg.* 28 no. 3 pp. 481–486, 5 refs. Lancaster, Pa, 1938.

The possibility that larvae of various species of flies may cause intestinal myiasis in man is discussed from the literature. In view of the paucity of adequate experimental data on the subject, tests were

carried out in which dogs and cats were fed on living larvae, in various instars, of *Lucilia sericata*, Mg., *Phormia regina*, Mg., *Caliphora erythrocephala*, Mg., *Sarcophaga securifera*, Villen., *Cochliomyia macellaria*, F., and *Drosophila melanogaster*, Mg., all species that have been reported as causing intestinal myiasis in man. All larvae found in stomachs examined 1-3 hours after the infecting feed were dead, except in one case in which they were immobile and proved unable to pupate. Larvae found in large intestines examined after 5 hours were dead, but had not been digested. Only chitinous integuments were found in faeces passed within 36 hours of feeding. It is, therefore, difficult to understand how fly larvae could have produced the symptoms and pathology that have been attributed to them in the past, and it seems probable that a more thorough examination of cases would reveal that other agents are responsible.

CAUSEY (O. R.). *Phlebotomus of Siam with a Description of a new Variety*.—*Amer. J. Hyg.* **28** no. 3 pp. 487-489, 3 refs. Lancaster, Pa, 1938.

The sandflies recorded from Siam are *Phlebotomus squamipleuris*, Newst., which was found to be the most abundant species in Bangkok, *P. bailyi* var. *campester*, Sinton, females of which were taken round electric lights in March 1932, and *P. barraudi* var. *siamensis* n., which is described from two females in the Bangkok collection.

ADLER (S.). *Factors determining the Behaviour of Leishmania sp. in Sandflies*. [In Hebrew.]—*Harefuah* **14** no. 1-2 pp. 4-8. Jerusalem, 1938. (With a Summary in English pp. i-ii.) (Abstr. in *Trop. Dis. Bull.* **35** no. 12 p. 860. London, 1938.)

A comparison has been made of the ability of strains of *Leishmania tropica* from Crete and Palestine to infect examples of *Phlebotomus papatasii*, Scop., in the presence of different quantities of inactivated rabbit serum. In the case of the Cretan strain, which is normally transmitted by *P. sergenti*, Parr. [cf. *R.A.E.*, B **26** 257], infection took place with difficulty when the suspension ingested was made up with 50 per cent. serum, but with ease when it contained only 10 per cent. In the case of the strain from Palestine, which is normally transmitted by *P. papatasii*, infection occurred readily without regard to the concentration of serum in the suspension.

ONO (Z.). *On Insects of Hygienic Importance in Shinkyo and its Environs, Manchuria*. [In Japanese.]—*Ent. World* **7** no. 59 pp. 4-11. Tokyo, 1939.

Notes are given on the occurrence of the principal insects of medical importance in the neighbourhood of Shinkyo, in Manchuria. *Cimex lectularius*, L., is abundant in summer, sometimes occurring on dogs, and *Pediculus humanus*, L. (*corporis*, DeG.), is common. The prevalent mosquitos are *Anopheles hyrcanus* var. *sinensis*, Wied., *Aëdes vexans* var. *nipponii*, Theo., *Culex pipiens*, L., and *C. tritaeniorhynchus*, Giles. *Musca domestica*, L., adults of which first appear in April at 6°C. [42.8°F], becomes abundant in mid-June, but decreases in numbers in November. *Xenopsylla cheopis*, Roths., and *Ceratophyllus anisus*, Roths., are common on *Mus* (*Rattus norvegicus*). *Pulex irritans*, L., is

the predominant flea on dogs and is common on cats. *Ctenocephalides felis*, Bch., is more numerous on cats, but *C. canis*, Curtis, is scarce on dogs. A subspecies of *Ceratophyllus tesquorum*, Wagn., infests *Citellus mongolicus*, which is abundant in Manchuria and is regarded as a reservoir of plague.

BUXTON (P. A.). Quantitative Studies on the Biology of *Xenopsylla cheopis* (Siphonaptera).—*Indian J. med. Res.* **26** no. 2 pp. 505-530, 3 figs., 2 graphs, 22 refs. Calcutta, 1938.

In order to obtain quantitative information on the climatic factors that influence the multiplication of *Xenopsylla cheopis*, Roths., an attempt has been made to maintain a mouse and fleas for a relatively long period under conditions that are as natural as possible and yet can be measured and controlled. The apparatus and technique are described in detail, since the author considers that they may be suitable for other work. The results obtained are discussed, particularly in relation to the physiology of the flea so far as it is known, to observations made in the field on the prevalence of fleas and their relation to plague, and to the limitations of the "flea count" technique as a means of measuring the natural population of fleas.

The irregularity in the numbers of parent fleas that survived appears to be due mainly to their being devoured by the mouse, since survival up to 7 days (the experimental period) does not seem to be affected by temperature or humidity. The proportions of the parent fleas on the mouse and in the bedding varied greatly, and the variation did not appear to be related to climatic conditions. Emergence of fleas of the first filial generation was closely dependent on humidity, and no emergence took place when the saturation deficiency was above a certain figure, which was not the same for all temperatures. The period occupied by the early stages was also influenced by humidity, probably because the growth of the larvae is retarded when the water content of the food is low.

ROY (D. N.). On the Number of Eggs of the common House-frequenting Flies of Calcutta.—*Indian J. med. Res.* **26** no. 2 pp. 531-533, 5 refs. Calcutta, 1938.

Counts of the mature eggs in the ovaries of gravid females of *Musca domestica vicina*, Macq., *M. nebula*, F., and *Chrysomyia megacephala*, F., three of the common domestic flies of Bengal, indicated that the average numbers in batches of eggs laid by females of these species are, respectively, 97, 75 and 182 in spring and rather less in winter. Thus, *M. d. vicina* apparently lays fewer eggs in a batch than the typical form, according to the literature, and an experiment similar to one carried out by Dunn suggested that females of the subspecies do not deposit batches of eggs at intervals of less than three days [cf. *R.A.E.*, **B** **11** 52].

SEN (Purnendu). A Note on the Overwintering of the House Fly, *Musca domestica*.—*Indian J. med. Res.* **26** no. 2 pp. 535-536, 3 refs. Calcutta, 1938.

Observations on house-flies (*Musca domestica*, L.) caught at Muktesar, United Provinces, at intervals during the winter of 1937-38, indicated that this species does not hibernate in the Indian hills.

BACIGALUPO (J.). Nuevo huesped intermedio de la *Hymenolepis diminuta* (Rudolphi, 1829) *Embia (Rhagadachir) argentina*, Navas.—*Rev. Med. trop. Parasit.* **4** no. 1 pp. 45-47, 1 pl., 5 refs. Habana, 1938.

In the course of investigations in Argentina to determine the part played by *Anisolabis annulipes*, Lucas, as an intermediate host of *Hymenolepis diminuta* [cf. R.A.E., B **24** 195], two examples of *Embia argentina*, Navas, were found among the earwigs, which were being fed on bread contaminated with the eggs of *H. diminuta*. One died 12 days after feeding on infected material, and immature larvae of the worm were found in the general cavity; the other, which died after 45 days, contained a mature cysticercoid. All but one of the examples of *A. annulipes* escaped infection [cf. loc. cit.]. Other intermediate hosts of *H. diminuta* that have been found in Argentina are *Dermestes vulpinus*, F., *D. peruvianus*, Cast. [19 21], and *Ulosonia parvicornis*, Fairm. [18 46]; the last two species appear to be the normal hosts of the worm.

DE SOUZA LOPES (H.). Sur une fausse myiasis des poules produite par la larve de la *Lucilia eximia* Wied. (Dipt.-Calliphoridae).—*C. R. Soc. Biol.* **129** no. 27 p. 426. Paris, 1938.

The author records the finding in Brazil of two larvae of *Lucilia eximia*, Wied., feeding on the débris of the epithelial tissues produced on the surface of the feet of a fowl by the mite, *Cnemidocoptes mutans*, Robin & Lanquetin.

DE SOUZA LOPES (H.). Sur quelques diptères porteurs d'oeufs de la *Dermatobia hominis* L. J. au Brésil (Dipt.-Oestridae).—*C. R. Soc. Biol.* **129** no. 27 pp. 427-428. Paris, 1938.

In these notes on the Diptera that have been found to carry the eggs of *Dermatobia hominis*, Say, in Brazil, the author points out that an illustration in the paper of Neiva and Gomes [R.A.E., B **7** 65] shows that *Neivamyia lutzi*, Pin. & Fons., was one of the species with which they were working, although it was not described until 13 years later [19 90]. The flies on which the author has found eggs are *Fannia petrocchiae*, Shan. & del Ponte, a species of *Fannia* suspected to be *F. heydeni*, Wied., and *Morellia* sp. He also states that *Musca (Sarcopromusca) arcuata*, Tns. [cf. **21** 224] is a synonym of *M. (Orthellia) pruna*, Shan. & del Ponte.

DIAS (E.). Persistance de l'infection par le *Schizotrypanum cruzi* chez l'homme. Xénodiagnoses positifs dans deux cas, 16 ans après l'isolement.—*C. R. Soc. Biol.* **129** no. 27 pp. 430-431, 3 refs. Paris, 1938.

The author records the persistence of *Trypanosoma (Schizotrypanum) cruzi* for 16 years in the blood of two persons in Brazil, who had been safeguarded during this time from all possibility of reinfection [cf. R.A.E., B **23** 16]. Laboratory-reared examples of *Rhodnius prolixus*, Stål, *Triatoma infestans*, Klug, *Eutriatoma (T.) sordida*, Stål, and *Panstrongylus megistus*, Burm., were fed at intervals on these persons, but the trypanosome was found only in *P. megistus*, the percentage infected ranging from 25 to 63.7.

BONE (G.). **Mode de transmission du spirochète de Dutton par les ornithodores moubata.**—*C. R. Soc. Biol.* **129** no. 32 pp. 901-903, 4 refs. Paris, 1938. **L'infection des ornithodores moubata par le spirochète de Dutton.**—*T.c.* pp. 903-905, 5 refs.

In the first paper, it is pointed out that the actual means by which *Spirochaeta duttoni* is transmitted by *Ornithodoros moubata*, Murr., is much disputed. There are three possible ways, namely, in the secretion of the salivary glands, in the secretion of the malpighian tubes, which escapes from the anus ("faecal material"), or in the coxal fluid, which is exuded from the coxal orifice during the feeding of the tick. In the author's experiments, the coxal fluid of both nymphal and adult ticks was shown by injection into mice to be infective, even when the tick had taken its infecting feed in the adult stage. Ultramicroscopic examination often revealed the presence of large numbers of spirochaetes, there being several per field in the first drop excreted. To test whether the secretion of the salivary glands was concerned, ticks fed 15 days to several months previously on infected mice were allowed to suck a small quantity of blood from healthy mice, but were removed before any coxal fluid had escaped. These experiments were carried out with 200 nymphs hereditarily infected and taking their first meal, 50 nymphs that had taken their only previous meal on an infected mouse, 87 nymphs that had fed once or several times on normal mice before taking their infecting feed, and 10 adults. None of the mice became infected. To test the infectivity of "faecal material," fluid escaping from the anus of ticks placed on their backs under a dissecting microscope was taken up by means of a pipette and injected intraperitoneally into mice. This material was taken from ticks under the most varied conditions, but no infection was produced in the mice. From these results it is concluded that transmission takes place through the coxal fluid.

In the second paper, it is pointed out that the question whether *S. duttoni* undergoes a cycle of development in the tick is also much disputed. According to the author's observations on ticks fed on infected mice, the spirochaetes make their earliest appearance in the coelomic cavity 2 days after the infecting meal. They were seen there after 2 days in 3 out of 17 ticks examined, after 4 days in half the ticks used, and after 8 days in practically all. There they gradually multiply and persist indefinitely. They were observed to persist in the stomach for at least 10 days and appear to traverse the stomach wall progressively. To determine whether passage through the stomach wall was aided by distension of the stomach, ticks were removed from an infected mouse after feeding for a short time only; half the batch were then allowed to complete engorgement on a healthy mouse. Examination a few days later showed that spirochaetes were present in the coelomic fluid of 75 per cent. of the engorged group and in only 12 per cent. of the group in which the stomach wall was not distended. An increase in the number of spirochaetes in the coelomic cavity of infected ticks was observed at the time of feeding on a healthy mouse. If this sudden increase were due to the liberation of spirochaetes in the course of development within the stomach wall by the passage of the liquid from the stomach towards the coxal glands through the coelomic cavity, spirochaetes should be demonstrable in the stomach wall before a blood meal, and this has never been found to be the case. It seems probable that it is due to the multiplication of the spirochaetes

in the coelomic cavity at the time when liquid is supplied by transudation from the stomach. Thus, in certain cases the multiplication does not begin until after the end of the meal and consequently after the liquid has ceased to flow ; it continues for several hours, and therefore up to a time when there can be no very active transudation. It has been brought about by direct inoculation into the coelomic cavity of small amounts of liquid from the coelomic cavity of ticks fed on healthy mice. Spirochaetes can develop in the coelomic cavity without having passed through the stomach or stomach wall, for when spirochaetes from the blood of mice were transferred directly by means of micropipettes to the coelomic cavity of ticks through the cut end of a leg, they were afterwards seen in the coelomic fluid, and mice were subsequently infected by the coxal fluid. Moreover, when ticks thus infected were fed on healthy mice, an increase of spirochaetes similar to that already mentioned was observed. The author concludes that the parasite multiplies in the tick without undergoing any developmental cycle.

LENNOX (F. G.). **Fleece Investigations.**—*Pamphl. Coun. sci. industr. Res. Aust.* no. 83, 27 pp., 1 pl., 5 graphs, 11 refs. Melbourne, 1938.

The moisture content of the fleece has long been known to influence susceptibility of sheep to blowfly strike. The opinion, implied or expressed, of all Australian investigators is that the fleece and skin must be definitely wet before a strike can develop, an opinion that is supported by a long series of observations on Merino sheep at Canberra. On the other hand, Davies and Hobson [*cf. R.A.E.*, B **23** 227], working with British breeds of sheep in Wales, considered that the relative humidity of the micro-climate at the base of the fleece was the important factor and that the moisture content of the fleece was an index of it. From a series of fleece-moisture determinations, they concluded that a relative humidity approaching saturation was necessary for a strike to develop ; they did not consider free moisture. The apparent differences in the results reported by the English and Australian workers, the need for evolving a method of measuring free moisture, and the desirability of determining whether the "wettability" of a fleece is related to moisture-absorption capacity led to the investigations described in the first of the papers contained in the present pamphlet, which is entitled Moisture Absorption by the Fleece and its Relation to Blowfly Strike (pp. 7-21). Details are given of laboratory experiments undertaken to determine the moisture-absorption capacity of raw fleece and of the three fractions, water-soluble material, ether-soluble material and wool fibre, at constant temperature and various humidities, of raw and scoured fleece at different temperatures and humidities, and of field tests to determine the effect of rain on the moisture content of the fleece.

The following is taken from the author's summary : Variation in the amount of moisture held at any particular atmospheric humidity may be chiefly accounted for by variation in the ratio of water-soluble material to the sum of the remaining components (including fibre). It should be possible to predict that a given sample of fleece will exhibit a capacity for water vapour roughly in direct proportion to this ratio, and claims that wool takes up constant amounts of moisture are open to severe criticism. If the fleece is protected from such natural

wetting agencies as rain or dew, changes in the moisture contents of wool or wool fibre are brought about only by alteration of the relative humidity of the atmosphere, irrespective of temperature changes. Free water may be present in the fleece without the fibres in close proximity being saturated, and it is shown that total moisture content is not a reliable index, either of the relative humidity of the micro-climate in the fleece, or of the amount of free moisture present. It cannot, therefore, be used as an index of susceptibility or non-susceptibility to blowfly strike.

HUNTER (L.). Domestic Pests. What they are and how to remove them.

—Demy 8vo, xii + 235 pp., 116 figs., many refs. London, John Bale, Sons & Curnow, Ltd., 1938. Price 7s. 6d.

In this book an attempt has been made to give essential information on household pests, both plant and animal, that directly affect the health of man or contaminate or destroy food, clothes and furniture. The first part contains general remarks on such points as the nature and importance of domestic pests (most of which are Arthropods), the knowledge necessary for their successful control, and the mechanical, physical and chemical means that may be used to accomplish this end. In the second part, brief descriptions are given of each pest and its bionomics, together with notes on simple methods for its control and a list of references.

LACOUR (P.). Étude biologique de la race rurale de *Culex pipiens* L.—

125 pp., 16 figs., 9 pp. refs. Clermont-Ferrand, Fac. Sci. Univ. Clermont, 1937. [Recd. 1939.]

In the introduction to this detailed account of the biology of the rural anautogenous race, *pipiens*, of *Culex pipiens*, L., in France, the author points out that although Roubaud [R.A.E., B 21 266] made a complete study of the urban autogenous race, *molestus*, Forsk. (*autogenicus*, Roub.) and gave a description of the characters distinguishing the two races, his conclusions regarding race *pipiens* seem to be based on insufficient data. The active life of the latter race is limited to a few months of each year, and rearing can only be carried out in insectaries, so that its study required both more time and more space.

The following subjects are dealt with in the chapters that succeed a brief review of the literature : Conditions of rearing ; examination of certain morphological characters ; life of the rural race in nature ; biological study of the larvae ; absence of autogenesis ; eurygamy and oviposition ; absence of cyclic fatigue ; hibernation ; and general considerations on the life-cycle. A summary of the work and the conclusions that are drawn from it are appended.

[KHODUKIN] CHODUKIN (N. I.) & [SHTERNGOL'D] STERNHOLD (E. A.).

On the Zoophily and Anthropophily of some *Anopheles* of Central Asia. [In Russian].—Usbekistansk. Parasit. Sb. 1 pp. 85-101, 18 graphs., 1936. (Abstr. in Italian in Riv. Malariol. 17 (1) fasc. 1-4 bis pp. 107-108. Rome, 1938.)

Examination of 986 females of *Anopheles maculipennis* var. *sacharovi*, Favr, *A. pulcherrimus*, Theo., *A. superpictus*, Grassi, and *A. hyrcanus*,

Pall., captured in dwellings and animal quarters round Tashkent showed that 19, 18, 22 and 15 per cent., respectively, contained human blood, and 20, 17, 15 and 9 per cent. contained mixed blood. Except for females of var. *sacharovi*, the majority contained the blood of cattle. Some individuals even contained the blood of frogs. These data are not considered a sufficiently reliable basis for conclusions as to the food-preferences of the species concerned.

The authors discuss the supposed correlation between maxillary indices and preference for feeding on animals, and conclude that such a correlation has not yet been definitely established. There appears to be, however, a relation between these indices and infectibility with malaria parasites. Though it was not possible to ascertain the degree of zoophily of the species examined, animal deviation was found useful, especially where the animal quarters were properly distributed.

SOLODOVNIKOVA (O.). [The Physiological Condition of Females of *A. maculipennis* var. *sacharovi* and *A. superpictus* in the District of Samarkand (Uzbekistan) during the estivo-autumnal Season.]
 [In Russian].—*Uzbekistansk. Parasit. Sb.* **1** (2) pp. 161–169, 2 pls., 1 graph, 1936. (Abstr. in Italian in *Riv. Malariaol.* **17** (2) fasc. 1–4 bis p. 149. Rome, 1938.)

The transition from summer activity to winter rest was studied in females of *Anopheles maculipennis* var. *sacharovi*, Favr, of which 430 were dissected between June and November, and *A. superpictus*, Grassi, of which 130 were dissected between August and November, most of these individuals having been taken in dwellings, and the others in animal quarters near Samarkand. Females of var. *sacharovi* showing partial gonotrophic dissociation were observed in August and slowly increased in numbers in September. Individuals in which the dissociation was complete were observed in September, and in November all those examined contained a developed fat-body. Females of *A. superpictus* showing gonotrophic dissociation were not observed until November, and by the end of that month all those dissected contained fat-body.

DE BUCK (A.). Eine Lokaluntersuchung über das Brüten von Anophelen in Süß- und Brackwasser. [A local Investigation on the Breeding of *Anopheles* in fresh and brackish Water.]—*Riv. Malariaol.* **17** (1) fasc. 5 pp. 344–357, 1 fig. Rome, 1938. (With Summaries in Italian and French.)

In Holland, *Anopheles maculipennis* race *messeae*, Flni., is almost entirely absent from brackish water districts, whereas race *atroparvus*, van Thiel, occurs in them in enormous numbers. In the fresh water districts, *messeae* may abound and *atroparvus* be entirely absent. This distribution of the two races was confirmed by work in 1933–35, [cf. *R.A.E.*, B **24** 282] in which 24,260 larvae from 907 breeding places were examined. In the purely fresh water districts, 90 per cent. of the larvae were *messeae*, whereas only 1–3 per cent. were in water with a high salt content. Laboratory experiments have shown, however, that both races can breed successfully in fresh water [cf. *27* 50].

In 1931, the author observed that in the Mijdrechter polder, near Amsterdam and on the boundary between the areas of distribution of the two races, some channels contained fresh water and others nearby

very brackish water (up to 5,000 mg. Cl per litre). In the brackish water, only larvae of race *atroparvus* were taken, while in the fresh water nearly all the larvae were of race *messeae*. In experiments, however, both races bred in fresh water and in brackish water, and the ovipositing females of *atroparvus* showed a greater preference for fresh water than did those of *messeae*.

A detailed account is given of further observations in this polder, where from 1933 to 1938 the author collected 69,000 eggs and 15,000 larvae. The polder contains a very brackish zone of water with 1,500–5,000 mg. Cl per litre (average 3,500), and a fresh water zone to the west of it, in which most of the channels contain fresh water with less than 500 mg. (average 180), while a few are slightly brackish (500–1,500 mg.). The two zones are separated by an area, about 325 yards wide, in which most of the channels are slightly brackish, and to the east of the brackish zone there is an area about 540 yards wide with channels of fresh water and a few channels of slightly brackish water. The chloride content in the channels varies very little, as was shown by observations since 1926.

The results are summarised as follows: In the brackish zone, the percentage of race *messeae* was small. It was, however, the same for eggs and larvae in the water as for adults in animal quarters, showing that the ovipositing females do not avoid very brackish water. It was not possible to ascertain if such water was less suitable for the larvae of *messeae* than for those of *atroparvus*. In the fresh water zone, most of the adults in animal quarters belonged to race *atroparvus*. In the channels, the proportion of the races varied widely, both occurring in purely fresh water. Two types of fresh water could be differentiated. In one, 81 per cent. of the eggs were of race *messeae*, while in the other, 88 per cent. were *atroparvus*. In the latter, the larvae were observed in the same proportion, while in the former the mortality of *atroparvus* larvae was much greater than that of *messeae* larvae. Since both types of water were similar as regards hardness, pH, oxygen, KMnO_4 , iron, bacteria, ferments and vegetation, some unknown factor must be responsible for the difference. In the channels to the east of the brackish zone, when there are no animal quarters, race *messeae* was very scarce. It is not possible to say whether or not this is due to the vicinity of the enormous *atroparvus* population of the brackish zone, but it may possibly be connected with some quality in the water, and this supposition is supported by the absence of a greater mortality among larvae of *atroparvus*.

While the causes of these phenomena are as yet unknown, it would certainly seem that the salt content does not influence the choice of breeding water by ovipositing females.

SINTON (J. A.). **The Action of Atebrin upon the Gametocytes of *Plasmodium falciparum*.**—*Riv. Malariaol.* **17** (1) fasc. 5 pp. 305–330, 1 col. pl., 2 figs., 1 chart, 48 refs. Rome, 1938. (With a Summary in Italian.)

In the course of this paper on the effect of atebrin on *Plasmodium falciparum*, the author describes observations on females of *Anopheles maculipennis* var. *atroparvus*, van Thiel, fed on patients infected with the Rumanian strain of *P. falciparum*. From the results he concludes

that at least some of the gametocytes taken up by mosquitos from patients that had been or were being treated with atebrin continue their development up to the oöcyst and sporozoite stages and become capable of infecting man, and that, while atebrin may affect the morphology of the developing crescents in most instances, it does not affect their viability in the mosquito to any great extent, or the infectivity of the sporozoites produced after the completion of the cycle of sporogony.

SHUTE (P. G.) & UNGUREANU (E.). Comparative Studies of the Eggs of *Anopheles maculipennis* var. *atroparvus* in the Field and in the Laboratory.—*Riv. Malariaol.* **17** (1) fasc. 5 pp. 358-361, 2 pls. 2 refs. Rome, 1938. (With a Summary in Italian.)

The authors have compared the eggs from an English strain of *Anopheles maculipennis* race *atroparvus*, van Thiel, derived from a female taken on the Thames estuary and maintained for 5 years in the laboratory [cf. *R.A.E.*, B **25** 43], with those from females taken in the same locality. The eggs of the laboratory-bred strain showed little variation from type, but considerable variation was observed among those from the wild mosquitos. The differences are discussed with respect to the identification of race *atroparvus*.

BEVERE (L.). Prime osservazioni sulla fauna anofelinica della Capitanata. [First Observations on the Anopheline Fauna of Capitanata.]—*Riv. Malariaol.* **17** (1) fasc. 5 pp. 362-385, 1 map, 24 refs. Rome, 1938. (With a Summary in English.)

After reviewing from the literature various factors governing the breeding of Anophelines, the author gives an account of his observations on the Anopheline fauna in the province of Foggia, South Italy, in many parts of which malaria is endemic. The province comprises a central plain extending almost to the Adriatic and two mountain regions, one north-east and the other south-west of the plain. There is great local diversity in climate, geology, hydrography, cultivation, raising of animals, and density of population. These factors are examined for 18 localities throughout the province, but no definite or general conclusions could be drawn.

The Anophelines found were *Anopheles maculipennis*, Mg., represented by races *maculipennis* (*typicus*), *labranchiae*, Flm., *atroparvus*, van Thiel, and *sacharovi*, Favr (*elutus*, Edw.), *A. superpictus*, Grassi, and *A. hyrcanus* var. *pseudopictus*, Grassi. Some species and races showed great adaptation to different local climates and perhaps have a more marked ability in seeking out the microclimatic conditions best suited to them. Race *atroparvus*, for instance, was found both in the plain and in high hills, while race *labranchiae* occurred only in the plain and low hills. Race *maculipennis* was found in the plain and the hills, but not at such high altitudes as *atroparvus*. No relation could be established between various densities of population and domestic animals in a given zone and the presence in that zone of anthropophilous or zoophilous mosquitos.

MIRA (M. G.). **Accertamenti sullo stato endemico della malaria nelle zone di Moggio—regione del Lago Zuai-Dessie—regione del Lago Haik-Ambò.** [Endemicity of Malaria in the Moggio Area, the Region of Lake Zuai, Dessie, the Region of Lake Haik, and Ambò.] —*Rass. sanit. Impero* 1 no. 4-5 pp. 9-30, 4 pls., 25 refs. Addis Ababa, 1938.

Information obtained during an inspection in 1937 is given on the epidemiology of malaria in various districts in Abyssinia, with notes on topography and climate. In the Moggio area, larvae of *Anopheles constani*, Lav., *A. pharoensis*, Theo., *A. demeilloni*, Evans, and *A. cinereus*, Theo., the first two of which are known to transmit malaria, were observed in the river Moggio and in wells along its banks. The disease is endemic in this area and also in that of Lake Zuai, where the author was unable to investigate the Anopheline fauna. In the region of Dessie, larvae of *A. demeilloni*, *A. constani*, *A. cinereus*, and *A. pretoriensis*, Theo., were found in two streams; the last-named species is regarded as mainly responsible for endemic malaria in both valleys. No Anophelines were observed in an examination of the shores of Lake Haik. At Ambò, at an altitude of about 6,600 ft., there was no endemic malaria; larvae of *A. demeilloni* were found in a stream in the town.

Extrait du rapport annuel sur l'activité du service antipaludique en 1937. —*Bull. Inst. Hyg. Maroc* 1938 no. 1-2 pp. 109-133, 1 graph. Rabat, 1938.

In the course of the section of this extract that deals with the work carried out for the control of mosquitos in Morocco in 1937 (pp. 110-115), it is stated that in general the results obtained in the anti-larval campaign were excellent. Few or no adults were captured at the catching stations, whether they were in urban centres or in the villages near Anopheline breeding places, so that protection against Anophelines is considered effective. Other mosquitos were also destroyed in most of the sectors. Curves representing the seasonal abundance of Anophelines in the regions of Rabat and the Rharb show the same annual variations. The number of adults captured in houses is very low during the first three months of the year; it increases slowly in April and May, and suddenly reaches its maximum in June and July. In coastal regions with a maritime climate, it falls suddenly in the second half of August, but in zones with a more continental climate, it falls at the beginning of July. Thereafter, the number remains low until December except for a slight rise in October. The peak in June and July is followed by an outbreak of malaria at the end of July and in August. Enormous numbers of Anophelines appeared at the edges of the marshes of the Rharb, but remained localised and did not migrate.

Anopheles maculipennis, Mg., race *sacharovi*, Favr (*clutus*, Edw.) has been found in the vicinity of Rabat, and since the flight range of this Anopheline is greater than that of others, the area in which anti-larval measures are carried out has had to be extended. The vector of malaria in the region of Marrakech appears to be *A. hispaniola*, Theo., which finds favourable breeding places in the foothills of the Great Atlas.

COLLIGNON (E.). **La campagne antipaludique de 1937 dans le département d'Alger.**—*Arch. Inst. Pasteur Algér.* **16** no. 3 pp. 323-337, 4 pls., 2 diagr. Algiers, 1938.

AMBIALET (R.). **La campagne antipaludique de 1937 dans le département de Constantine.**—*T.c.* pp. 338-350, 3 pls., 2 figs.

GOUGET (R.). **La campagne antipaludique de 1937 dans le département d'Oran.**—*T.c.* pp. 351-359, 4 pls., 3 figs.

Accounts are given of the work carried out and the results obtained in the campaigns against Anophelines and malaria in Algeria in 1937 [cf. *R.A.E.*, B **26** 67]. The usual measures were employed against Anopheline larvae. The satisfactory results that were obtained in all departments were partly due to the climatic conditions, which were unfavourable for the breeding of Anophelines.

GILLET (R.). **Etude épidémiologique du paludisme à El Goléa en 1937.**—*Arch. Inst. Pasteur Algér.* **16** no. 3 pp. 360-381, 4 pls., 1 plan, 2 refs. Algiers, 1938.

In the course of this report on malaria in the oasis of El Goléa in the Algerian Sahara [cf. *R.A.E.*, B **23** 102], the breeding places of *Anopheles multicolor*, Camb., and *A. sergenti*, Theo., the only two Anophelines, are described, and an account is given of the usual temporary anti-larval measures employed and of the permanent measures of drainage, filling, etc., that have been carried out since 1933 or are now in the course of execution, with suggestions for future work on the same lines.

HENRY (C.). **La lutte antipaludique en Tunisie.**—Med. 8vo, 200+2 pp., 6 figs., 1 graph, 2 fldg. maps+1 overlay, 2 fldg. tables, 8 pp. refs. Paris [1935] [Recd. 1939.]

In this thesis, the author has collected together information concerning malaria and its control in Tunisia [cf. *R.A.E.*, B **23** 188; **26** 235; etc.]. After briefly describing the geography of the country and malaria in relation to its history, he discusses firstly the epidemiology of the disease under the headings of essential factors, which comprise Anophelines, malaria parasites, and gametocyte carriers, and of secondary factors, which comprise climate, relief and altitude, vegetation, hydrography and movements of the population, and secondly its endemicity, epidemicity and distribution. He then gives an account of the malaria control campaign, its history, its present organisation, and the details of its work, which includes the making of surveys, the administration of drugs, and the carrying out of temporary measures against adults and larvae of Anophelines, and of permanent measures such as drainage, filling, etc., to prevent breeding.

MACKIE (F. P.) & CRABTREE (H. S.). **The Destruction of Mosquitoes in Aircraft.**—*Lancet* **235** pp. 447-450, 3 figs. London, 1938.

After discussing the desirability of applying measures for the control of insect pests in aircraft during flight rather than at airports [cf. *R.A.E.*, B **27** 31, 48], the authors give a brief account of the work that has been carried out by the Imperial Airways Company to perfect methods for accomplishing this. A list is given of the properties required in an insecticide for use in aeroplanes, and it is pointed out that

kerosene-base insecticides are inflammable and that the introduction of carbon tetrachloride to reduce inflammability gives rise to unpleasant after-effects on man, such as headache, sore throat and vertigo, and the repeated application of a fluid containing kerosene will saturate cushions and textiles eventually and render them highly inflammable. For this reason an aqueous-base pyrethrum insecticide [cf. 27 31] was used. The ventilation system of the Imperial flying boat is described and illustrated. The wings are well-ventilated by a large volume of fresh air moving at a high speed, and there is no record of living mosquitos being found in them [cf. 27 47]. The spray was applied by means of a Phantomyst sprayer and Larmuth ejectors, which are briefly described [27 48]. The position of the Larmuth appliances and the position and number of jets worked by each are shown in a diagram, and a table gives the capacity of each cabin or compartment, the type of apparatus used and the number of cubic centimetres of insecticide discharged in each, and the position of the Larmuth ejectors and the number of jets worked by each. The total weight of the equipment installed in one flying boat carrying 6 ejectors was 32 lb.

A summary is given of the experiments that have been carried out. In the first, mosquitos were killed within 8-13 minutes after exposure to 18 cc. of the aqueous-base insecticide (1 : 14) in a space of 1,100 cu. ft. In the second, a flying boat, which was fitted with ejectors and supplied with a Phantomyst nebuliser, was flown on the normal route to Durban via Cairo and Khartoum, Kisumu and the East African ports, and demonstrations of the disinfesting procedure were given to government sanitary officials at the places named. The demonstrations were on the whole successful, and most comments were favourable. A few minor defects were noted, but were readily overcome. The third experiment was carried out in a flying boat in flight over Southampton in order to test the influence of air currents and to assess the value of the principle of disinfestation during flight. This experiment was entirely successful, since insects in cages in different parts of the aeroplane were killed in 2-11 minutes. The fourth experiment was carried out under similar conditions but in the presence of a number of authorities [cf. 27 31]; the results obtained were similar, except that action was delayed in two of the cages and two mosquitos survived until the next day; the causes were mechanical and easily remedied. The fifth experiment was carried out by C. B. Symes in a furnished room with a capacity of 1,920 cu. ft., using 28.5 cc. of the aqueous-base insecticide (1 : 14). Mosquitos belonging to 14 different species, including members of the genera *Aedes*, *Culex* and *Anopheles*, in cages placed in various positions in the room were exposed to the vapour for 5 minutes and then removed to fresh air. Over half the mosquitos were brought down in 5 minutes, none was capable of flight after 25 minutes in the open air, and none ultimately recovered. These experiments show that the action of pyrethrum may be delayed and that some mosquitos that appear to be unaffected have actually received a fatal dose. The latest experiments are those of J. W. Munro, who states that the dose used should be 150 cc. of the aqueous-base insecticide (1 : 30) per 1,000 cu. ft. air space and that there should be 15 minutes interval between spraying and ventilation. He used *Culex fatigans*, Wied., in groups of 50-70, which were kept under observation for 24 hours after treatment. In a chamber of approximately 21 cu. ft., all the mosquitos were killed by doses of 3.0, 2.5 or

2.0 cc., and doses of 1.5, 1.0, 0.75 and 0.5 cc. gave mortalities of 99.5, 97, 88 and 76 per cent., respectively. The mortality of control mosquitos was less than 6 per cent. He concludes that if the conditions in aeroplanes do not differ widely from those in the laboratory, in which the temperature was 23–24°C. [73.4–75.2°F.] and the relative humidity 30–40 per cent., this insecticide should prove satisfactory for the control of mosquitos. At the higher temperatures encountered in the tropics, its efficiency should be enhanced.

PAPERS NOTICED BY TITLE ONLY.

SALEM (H. H.). **The Mosquito Fauna of Sinai Peninsula (Egypt) with a Description of two new Species** [including *Anopheles aegypti*, sp. n., and *A. turkhudi*, List., new record for Egypt].—*Publ. Fac. Med. Egypt. Univ.* no. 16, 32 pp., 16 pls., 31 refs. Cairo, 1938.

SERGENT (Et.). **Détail anatomique des oeufs d'Anopheles maculipennis**.—*Arch. Inst. Pasteur Algér.* **16** no. 3 pp. 318–319, 2 pls. Algiers, 1938.

SENEVET (G.) & FRATANI (L.). ***Anopheles d'thali*, Patton, dans le Sud Oranais.**—*Arch. Inst. Pasteur Algér.* **16** no. 3 pp. 320–322, 6 refs. Algiers, 1938.

SOPER (F. L.). **Yellow Fever : The present Situation (October, 1938) with special Reference to South America.**—*Trans. R. Soc. trop. Med. Hyg.* **32** no. 3 pp. 297–322, 10 maps, 21 refs. London, 1938.

ZUMPT (F.). **1. Vorstudie zu einer monographischen Bearbeitung der Stomoxydinae. Taxonomische Ergebnisse des Studiums einiger Sammlungen, besonders der von Bezzi und Enderlein.** [First preliminary Study for a Monograph on the Stomoxydinae. Taxonomic Results of the Study of some Collections, in Particular those of Bezzi and Enderlein.]—*Z. angew. Ent.* **25** pt. 2 pp. 337–353, 1 fig., many refs. Berlin, 1938.

SALEM (H. H.). **A complete Revision of the Species of the Genus Wohlfahrtia B. & B. Diptera-Larvaevoridae-Metopiidae.**—*Publ. Fac. Med. Egypt. Univ.* no. 13, [4]+90 pp., 37 pls., 40 refs. Cairo, 1938.

KÉLER (S.). **Uebersicht über die gesamte Literatur der Mallophagen.** [A Survey of the Literature on the Mallophaga (a chronological list, 1668–1938, with alphabetical list of authors).]—*Z. angew. Ent.* **25** pt. 3 pp. 487–524. Berlin, 1938.

COOLEY (R. A.) & KOHLS (G. M.). ***Ixodes marmotae—a new Species of Tick from Marmots* [*Marmota* sp. in U.S.A.] (Acarina : Ixodidae).**—*Publ. Hlh Rep.* **53** no. 49 pp. 2174–2181, 20 figs., 2 refs. Washington, D.C., 1938.

SHANNON (R. C.), WHITMAN (L.) & FRANCA (M.). **Yellow Fever Virus in Jungle Mosquitoes.**—*Science* **88** pp. 110-111, 8 refs. New York, 1938.

In the course of an outbreak of jungle yellow fever in the State of Rio de Janeiro, mosquitos collected alive in the jungle near points where human infection had occurred were forwarded daily over a period of 11 weeks to a laboratory. The mosquitos were classified by species or groups of species, fed on monkeys (*Macacus rhesus*), and afterwards made into suspensions and injected intracerebrally into mice. A total of 24,304 mosquitos was classified into 6 groups consisting, respectively, of *Aëdes scapularis*, Rond., *A. leucocelaenus*, Dyar & Shannon, *Haemagogus capricorni*, Lutz (*janthinomys*, Dyar) and three groups of mixed species, of which the last included about 20 species belonging to the genera *Sabethoides*, *Limatus*, *Wyeomyia*, *Goeldia* and *Trichoprosopon*. Two monkeys on which batches of *A. leucocelaenus* and *H. capricorni*, respectively, had fed became infected, and a suspension of 88 individuals of the last group produced encephalitis in mice, although 21 of them, previously fed on a monkey, had failed to cause infection. The author regards *H. janthinomys* as a synonym of *H. capricorni* on the basis of information recently received from P. C. A. Antunes.

BENNETT (B. L.), BAKER (F. C.) & SELLARDS (A. W.). **The Behaviour of the Virus of Yellow Fever in the Mosquito, *Aëdes triseriatus*.**—*Science* **88** pp. 410-411, 3 refs. New York, 1938.

In the autumn of 1935, in an experiment carried out at the Harvard Medical School, about 35 females of *Aëdes triseriatus*, Say, were allowed to feed on a monkey (*Macacus rhesus*) infected with yellow fever; 7 survived an incubation period of 17 days at about 28°C. [82·4°F.] and 6 of these fed on a healthy monkey, which died of yellow fever 36 days later. In March 1938, mosquitos of the same species that had previously taken a blood meal on an infected animal were allowed to feed on four monkeys. None of these showed a febrile reaction, but two of them died of yellow fever after intervals of 10 and 13 days, respectively. Blood taken from the other two monkeys failed to protect mice. The two monkeys that survived had been bitten by mosquitos kept for 14-15 days at about 28°C., whereas those that succumbed were infected by mosquitos kept at 37°C. [98·6°F.]. The virus was recovered from 6 out of 10 mice into which suspensions of single mosquitos had been injected intracerebrally 13 to 16 days after they had ingested blood from infected monkeys.

HURLBUT (H. S.). **Further Notes on the Overwintering of the Eggs of *Anopheles walkeri* Theobald with a Description of the Eggs.**—*J. Parasit.* **24** no. 6 pp. 521-526, 5 figs., 2 refs. Lancaster, Pa, 1938.

During the autumn, winter and spring of 1936-37, further observations were made on the eggs of *Anopheles walkeri*, Theo. [*cf. R.A.E.*, B **25** 183]. Of 568 eggs laid between 5th and 23rd September by females caught at Ithaca, New York, 4 hatched a few days after they were laid; the others remained dormant throughout the winter and 201 hatched between 14th April and 10th May, when observations were discontinued. The eggs were kept out of

doors where the temperature ranged from 89 to -5°F . A few of the overwintering eggs, dissected 3 weeks after they were deposited, were found to contain living larvae that had apparently completed their embryonic development. A newly-hatched larva was collected in the field on 17th April. Detailed descriptions are given of the summer and winter eggs [*cf. loc. cit.*]. In September 1937, 106 eggs of the winter type were obtained from a female collected in Tennessee. Of these, 11 were preserved in formalin, and 72 of those that remained hatched in 4–5 days in the laboratory at Wilson Dam, Alabama. Of 14 eggs from this batch taken to Ithaca and placed out of doors on 1st October, 11 hatched between 21st and 24th March.

HOFFMANN (C. C.). *La formación de razas en los Anopheles Mexicanos.*

II. *Anopheles albimanus* y sus variedades en la República Mexicana.

[The Formation of Races in Mexican *Anopheles*. II. *A. albimanus* and its Varieties in the Mexican Republic.]—*An. Inst. Biol. Mex.* **9** no. 1–2 pp. 167–180, 7 figs., 12 refs. Mexico, D.F., 1938. (With a Summary in German.)

Anopheles albimanus, Wied., is the chief vector of malaria in the tropical regions of Mexico that are humid. Particulars are given of its distribution in Mexico, which is limited to these regions, and, within them, by the fact that the larvae require water exposed to sunlight and rich in micro-organisms. The variable characters of this species are discussed, and two new varieties are described from a small part of the Gulf region comprising the southernmost part of the State of Tamaulipas and the adjoining northern part of the State of Veracruz. One, *bisignatus*, occurred in various districts, while the other, *trisignatus*, which is apparently much rarer, was found only near Tampico. A female with the characters of *bisignatus* was recorded in 1935 by Martini as *A. rondoni*, Neiva & Pinto [*R.A.E.*, B **23** 254], a species that does not occur in Mexico.

HOFFMANN (C. C.) & SÁMANO B. (A.). *Los criaderos invernales de Anopheles pseudopunctipennis en el Estado de Oaxaca.* [The Winter Breeding Places of *A. pseudopunctipennis* in the State of Oaxaca.]—*An. Inst. Biol. Mex.* **9** no. 1–2 pp. 181–192, 3 figs., 5 refs. Mexico, D. F., 1938. (With a Summary in German.)

In the state of Oaxaca, as in all dry regions of southern Mexico, *Anopheles pseudopunctipennis*, Theo., is not only the most important but almost always the sole vector of malaria. Irrigation and water-supply works have contributed to its spread inland throughout Mexico and are often the main cause of malaria. The larvae require clean water exposed to sunshine and containing green algae. In Oaxaca, collections of rain water provide numerous breeding places during the rainy season, but breeding in the winter dry season is usually restricted to permanent collections of water, which in nature consist chiefly of pools containing algae in river beds [*R.A.E.*, B **25** 28]. These winter breeding places are relatively common in the temperate highlands, where the alga in them is *Hydrodictyon reticulatum*, and rare in the hot lowlands, where the alga is *Spirogyra*. So far as can be ascertained, hibernation of the females of *A. pseudopunctipennis* is exceptional in the temperate region, but more frequent in periods of extreme drought in the hot region.

HOFFMANN (C. C.) & SÁMANO B. (A.). Nota acerca de los criaderos invernales de *Anopheles albimanus* Wied. en los pantanos de Veracruz. [A Note on the Winter Breeding Places of *A. albimanus* in the Swamps of Veracruz.]—*An. Inst. Biol. Mex.* **9** no. 1-2 pp. 193-199, 2 figs. Mexico, D.F., 1938. (With a Summary in German.)

Anopheles albimanus, Wied., which is the most important vector of malaria on the coasts of Mexico, especially the Gulf coast, is abundant during the rainy season, when it is the predominant Anopheline on the Gulf coast, but decreases rapidly in numbers at the beginning of the dry winter, disappearing entirely in some places. As a rule, it increases progressively from March to a peak at the height of the rainy season in August–October. It depends primarily on permanent breeding places and is more closely connected with swamps than any other Mexican species. Particulars are given of the results of an examination early in March, the driest part of the year, of two breeding places in swamps near Veracruz, showing their position, vegetation and microbiological conditions.

VARGAS (L.). Observaciones sobre la preferencia alimenticia sanguínea de la *pseudopunctipennis* en Temixco, Morelos. [Observations on the Blood Meal Preference of *A. pseudopunctipennis* in Temixco, Morelos.]—*An. Inst. Biol. Mex.* **9** no. 1-2 pp. 201-208, 6 refs. Mexico, D.F., 1938.

In Temixco, a malarious locality in the State of Morelos, Mexico, a spleen index of 50 per cent. and a parasite index of 46 per cent. were found in October 1937, at the end of the rainy season, in the age group 5-19 years. The only Anopheline taken in houses was *Anopheles pseudopunctipennis*, Theo.; dissections showed that none of 801 salivary glands and 2·28 per cent. of 526 stomachs were infected. The results are given of precipitin tests in which only females that contained a single type of blood were considered. Of 245 taken in houses, 67·62 per cent. had fed on man; 13·52 on cattle; 10·66 on dog; 5·33 on horse; and 2·87 on pig. Of females taken in traps containing 3 people and an animal, the percentages that had fed on man were 26·7, 32·9, 85·5 and 95·5 when the animals were a horse, a cow, a pig and a dog, respectively, and 28·2 and 77·4 in two tests when they were donkeys.

SYDDIQ (M. M.). Some Observations of practical Importance and Interest for the Malariaologist.—*Indian med. Gaz.* **73** no. 11 pp. 676-679, 3 figs. Calcutta, 1938.

These miscellaneous notes include the recommendation of balls made of finely sifted road dust containing 2 per cent. Paris green mixed with water and dried for the control of mosquito larvae breeding in sullage water. Each ball weighs about 2 oz., and 2 balls are sufficient for about 8 cu. ft. water. The balls, which keep well when made up, are not effective in water more than 5 ft. deep and are not therefore suitable for use in wells. Experience has shown that a 1 per cent. Paris green dust applied once a week to rice crops has no injurious effect on the plants, and no damage was caused to young plants when this poison was kneaded into the mud in which they were grown, but a 2 per cent. dust applied twice a week destroyed the rice plants

entirely. Pieces of wood placed at intervals across drains containing running water in which breeding is taking place check the passage of mosquito larvae and retard the flow of larvicultural oil so that it remains in contact with the larvae long enough to destroy them. The following formula is recommended for making an ointment to repel adult mosquitos; 2 drachms bees wax, 4 drachms spermaceti, 4 drachms coco-nut oil, 4 drachms fuller's earth, 1 oz. liquid paraffin, 1 oz. citronella oil, and 10 minimis carbolic acid. The first two ingredients are melted in a water bath, and the others are then added, the last two just before the mixture solidifies.

ABE (S.). Development of *Wuchereria bancrofti* in the Mosquito—*Culex quinquefasciatus*. [In Japanese.]—*J. med. Ass. Formosa* **36** no. 3 pp. 483–519. Taihoku, Formosa, 1937. (With a Summary in English.) (Abstr. in *Jap. J. Zool.* **8** no. 1 p. (12). Tokyo, 1938.)

The author's study of the life-history of *Filaria* (*Wuchereria*) *bancrofti* in the body of the Formosan strain of *Culex fatigans*, Wied. (*quinquefasciatus*, auct.) confirmed previous work. The parasite moults twice and reaches the mature larval stage 15 days after the infecting feed at a temperature of 25–28°C. [77–82.4°F.]. Its morphology, anatomy and development are described.

HU (S. M. K.). Studies on the Susceptibility of the Shanghai Mosquitoes to Experimental Infection with *Wuchereria bancrofti* Cobbold. VI. *Culex vagans* Wiedemann.—*Peking nat. Hist. Bull.* **13** pt. 2 pp. 113–116, 2 refs. Peiping, 1938.

During 1934–35, experiments similar to those already noticed [R.A.E., B **27** 82] were undertaken in Shanghai to determine the susceptibility to infection with *Filaria* (*Wuchereria*) *bancrofti* of females of *Culex vagans*, Wied., reared from larvae collected locally. Of the 206 mosquitos dissected 13–21 days after the infecting feed, 189 harboured infective larvae. The average number of larvae per infected mosquito was 10.2; infestation was exceptionally heavy in a few of the mosquitos, and one dissected 13 days after the infecting feed harboured 111 infective larvae. The normal completion of development of so many larvae is considered to indicate that this species is a very suitable intermediate host. When a series of *C. vagans* was fed at the same time as a series of *C. pipiens* var. *pallens*, Coq., on the same infected person, 74 out of 78 of the former and 47 out of 49 of the latter were found to harbour infective larvae after 12–18 days, the average number of larvae per infected mosquito being 10.9 and 9.3, respectively.

SIOLI (F.), KENTENICH (A.) & BOLDT (E.). Weitere Erfahrungen über die Zucht der *Anopheles* und ihre Verwendung in der Malaria-behandlung der Paralytiker. [Further Experiences in the Breeding of *Anopheles* and of the Use of the Mosquito in the Malaria Treatment of Paralysis.]—*Arch. Schiffs- u. Tropenhyg.* **43** pt 1 pp. 1–15, 10 figs. Leipzig, 1939.

Slight modifications are described in the technique of breeding *Anopheles* [*maculipennis*, Mg.] at Düsseldorf-Grafenberg for the

treatment of paralysis by induced malaria [cf. R.A.E., B 24 236]. The strain is invigorated by the annual introduction of 100-150 adults taken in the district of the lower Rhine. Details are given of a large number of infections that have been induced.

DEL VECCHIO (G.). Sugli anofelini esistenti in Provincia di Littoria.

Nota preventiva. [The Anophelines existing in the Province of Littoria. Preliminary Note.]—*Riv. Malariol.* 17 (1) fasc. 6 pp. 425-430. Rome, 1938. (With a Summary in English.)

Of Anophelines caught between September 1937 and September 1938 in the province of Littoria, near Rome, 28,895 were taken in pig-sties and cow-sheds and 112 in dwellings. Eggs were obtained from 10,559 of the former and 43 of the latter. Identification based on egg characters gave the following incidence for animal quarters and (in brackets) for dwellings: *Anopheles maculipennis*, Mg., race *maculipennis* (*typicus*) 1,167 (5); race *labranchiae*, Flni., 5,148 (26); race *messeae*, Flni., 2,545 (2); race *melanoon*, Hackett, 122 (5); race *sacharovi*, Favr (*elutus*, Edw.) 5 (0); *A. claviger*, Mg. (*bifurcatus*, auct.) 1,475 (4); *A. algeriensis*, Theo. (the race with eggs as described by La Face [R.A.E., B 26 130]) 87 (1); *A. plumbeus*, Steph., 1 (0); and *A. hyrcanus* var. *pseudopictus*, Grassi, 9 (0).

The author concludes that the numbers of Anophelines in the province, and especially in the Pontine Marshes, have been reduced in recent years and that there has been a change in the species and varieties taken in a given zone. For instance, *A. maculipennis sacharovi* is practically absent in the coastal zone, where it once predominated, and this corresponds to the absence of primary cases of malaria during the past two years. *A. hyrcanus* var. *pseudopictus* has also almost disappeared. These changes are ascribed to physico-chemical changes in the breeding places due to the effect on the soil of drainage and cultivation. The decrease of Anophelines in general is due to drainage, dusting with Paris green, the use of *Gambusia*, and the destruction of mosquitos in pig-sties, etc. The very small proportion of mosquitos taken in dwellings is explained by the large numbers of cattle and pigs and to fairly general screening.

DE SOUZA PINTO (G.). L'invasion du Brésil par l'*Anopheles gambiae* et ses conséquences.—*Riv. Malariol.* 17 (1) fasc. 6 pp. 475-480. Rome, 1938. (With a Summary in Italian.)

The African Anopheline, *Anopheles gambiae*, Giles, was first observed in Brazil in 1930, when it was taken in Natal, the capital of Rio Grande do Norte, in March [R.A.E., B 18 150], and soon afterwards 10,000 cases of malaria occurred in a quarter of the town with 12,000 inhabitants, while the indices of infection in this mosquito were very high [19 188]. The author organised a campaign against it in Natal and in three coastal localities in the same State, to which it had probably been brought by the fast mail packets from Dakar (Senegal) [20 78]. Of examples from two municipalities in which malaria was severe, 71.5 and 28.2 per cent., respectively, harboured oöcysts and sporozoites. In 1931-32, *A. gambiae* spread up the Potengy and Ceará-Mirim rivers, and in 1937-38 it was found on the Assou and Mossoró rivers in Rio Grande, and on the Jaguaribe river in the state of Ceará. In Brazil, the malaria epidemics due to it are

extremely serious, both in the number of cases and the severity of some of them. Though the clinical symptoms are those of benign tertian, mortality is excessively high [20 78]. This is ascribed to the high rate of infection in the mosquitos with consequent large numbers of re-infections in man. In some villages, it is difficult to find one healthy inhabitant.

A. gambiae could always be found in dwellings in the infected areas and was never taken or seen on an animal. The larvae occurred chiefly in the stagnant water of pools common near dwellings after the rainy season and often in water in excavations. At Natal, they were also found in tanks in the courtyards and small gardens of houses.

KUIPERS (J.). **Methoden van onderzoek bij de malaria-bestrijding.** [Methods of Investigation in Malaria Control.]—*Geneesk. Tijdschr. Ned.-Ind.* **79** pt. 1 pp. 24–39, 10 refs. Batavia, 1939.

The author discusses inductive, deductive and statistical methods of investigating the relation of Anophelines to malaria in a given locality. In the inductive or empirical method, the vectors are identified and their breeding places surveyed to ascertain the actual danger present. In the deductive method, conclusions as to potential danger are drawn from existing conditions on the basis of previous experience. The explanation of an epidemic due to *Anopheles sundaicus*, Rdnw. (*ludlowi*, auct.) at Brengkok, Java [R.A.E., B **22** 66] is an instance of the application of this method. The two methods are complementary, as inconsistencies in biological processes hamper the use of the deductive method. Modern methods of calculation are extremely valuable in analysing the observations made and ascertaining the correctness of assumptions and statements, and mathematical-statistical investigations, the methods of which are outlined, are the most suitable for dealing with the problems.

SCHARFF (J. W.). **Some Methods of Malaria Control.**—*J. Malaya Br. Brit. med. Ass.* **2** no. 3 pp. 165–168. Singapore, 1938.

The author points out that malaria control in Penang has largely been brought about by "hydro-technical" measures, which aim at preventing Anopheline breeding by altering the area, depth, flow or tranquillity of waters in which the larvae are found. Such measures comprise drainage; flooding and silting; intermittently sluicing or flushing streams or open channels; agitating water surfaces by controlled natural, or artificial means; impounding water in cleaned-edged ponds, reservoirs or wells; periodically altering water levels; controlling agricultural irrigation waters; and changing the chemical composition of breeding water by introducing saline or other waters. Notes are given on sluicing or flushing [cf. R.A.E., B **25** 30] and on the agitation of water surfaces to prevent the oviposition of females and the survival of larvae [cf. **23** 131]. On Penang Hill, irrigation pools are kept filled by water from jungle-protected hill streams carried in split bamboo conduits arranged so that the water falls into the pool from a height of at least 4 feet. The splashing and rippling on the surface are sufficient to prevent breeding, and the surplus water is led by the same means into other pools situated at lower levels.

SEN (Purnendu). **Role of Mosquitoes in the Transmission of Animal Diseases.**—*Agric. Live-Stk India* **8** pt. 6 pp. 689–694, 13 refs. Delhi, 1938.

Notes, based largely on the literature, are given on the diseases of domestic animals, poultry and other birds that occur or may occur in India and are known or suspected to be transmitted by mosquitos.

FARINAUD (M. E.), RAMIJEAN (R.) & FAVOT (M.). **Nouvelles recherches sur le paludisme à Saigon.**—*Rev. méd. franç. Extr.-Orient* 1938 no. 7 pp. 878–888, 1 figd plan. Hanoi, 1938.

In the course of this account of the malaria situation in Saigon, Cochin China, where outbreaks are sporadic and of short duration, the authors state that, in spite of further surveys, the only species of *Anopheles* found were those mentioned by Borel and Le-van-An [R.A.E., B **16** 121], although in the list here given the name *A. fuliginosus*, Giles [*A. annularis*, Wulp] is replaced by *A. philippensis*, Ludl., without comment. Since the usual important vectors are absent, it is believed that transmission must be explained by sudden temporary increases in abundance of species that are poor vectors. All the more important foci of malaria in Saigon are near large collections of water, and pools become extremely numerous in the rainy season. It is at the change of the monsoon in November and December that there is usually an increase of Anophelines and of cases of malaria.

[RUIBINSKII (S.).] Рыбинский (С.). **Anophelism without Malaria in Connection with the Races of the Mosquito *Anopheles maculipennis* in the Flood-basins of the Middle Course of the River Desna.** [In Ukrainian.]—*Trav. stat. Hydrobiol.* **11** pp. 141–148, 29 refs. Kiev, 1936. (With Summaries in Russian and English.)

Malaria is endemic on the upper and lower Desna, in the Ukraine, but is not common in the region of the middle Desna, although *Anopheles maculipennis*, Mg., is abundant. Of larvae taken in 1933 in the river between Chernigov and Korop, 79, 17 and 4 per cent. belonged to races *messeae*, Flni., *atroparvus*, van Thiel, and *maculipennis (typicus)*. Race *atroparvus* was commonest near Korop. It is suggested that its comparative scarcity in the area studied accounts for the absence from it of endemic malaria.

PAVISIĆ (V.). **Ueber die Oekologie der Baumhöhlenmückenlarven in Jugoslawien.** [The Ecology of the Larvae of Tree-hole Mosquitos in Jugoslavia.]—*Arch. Hydrobiol.* **33** no. 4 pp. 700–705, 8 figs., 5 refs. Stuttgart, 1938.

The author describes and illustrates eight types of holes in trees and tree-stumps that serve as breeding places in Jugoslavia for *Aëdes geniculatus*, Ol. (*ornatus*, Mg.), *A. echinus*, Edw., *Anopheles plumbeus*, Steph. (*nigripes*, Staeg.) and *Orthopodomyia pulchripalpis*, Rond. (*albionensis*, MacGregor) [cf. R.A.E., B **26** 15]. The choice of a breeding place appeared to depend more on the type of hole than on the species of tree.

THIENEMANN (A.). **Die Stechmückenplage im hohen Norden.** [The Mosquito Nuisance in the Far North.]—*Forsch. Fortschr.* **14** no. 26-27 pp. 302-303, 1 ref. Berlin, 1938. **Frostboden und Sonnenstrahlung als limnologische Faktoren.** [Frozen Soil and Solar Radiation as limnological Factors.]—*Arch. Hydrobiol.* **34** no. 2 pp. 306-345, 3 pls., 5 figs., 21 refs. Stuttgart, 1938.

Observations in the district of Abisko, in Swedish Lapland, a brief account of which is given in the first paper, showed that the most numerous mosquitos were *Aëdes communis*, DeG., and *A. punctor*, Kby. They bred in collections of water that formed when the snow melted in spring, drainage being prevented until late in the season, or altogether, by the frozen subsoil. The temperature of two such collections of water from 25th May to 11th June 1938 was 13-22.4°C. [55.4-72.32°F.] during the day, while that of the air varied between 4.9 and 19.3°C. [40.82-66.74°F.]. The females apparently took blood from voles (*Microtus*) and lemmings. As the mosquito nuisance appears to be conditioned by climate, no method of control can be proposed.

In the second paper, in which a more detailed account is given of the same observations, it is stated that the other mosquitos observed comprised four species of *Aëdes* and *Theobaldia alaskaensis*, Ludl. They all had one generation a year and overwintered in the egg stage.

BROWN (F. R.) & PEARSON (J. W.). **Some Culicidae of the Reelfoot Lake Region.**—*J. Tenn. Acad. Sci.* **13** no. 2 pp. 126-132, 9 refs. Nashville, Tenn., 1938.

During investigations in the period June-September in 1936 and 1937 on the mosquito fauna of Reelfoot Lake, Tennessee, 20 species of mosquitos were taken. The Anophelines comprised *Anopheles quadrimaculatus*, Say, which was the most numerous, *A. walkeri*, Theo., which attacked man readily but rarely entered dwellings, *A. crucians*, Wied., which fed on cows, *A. punctipennis*, Say, and *A. barberi*, Coq., a few larvae of which were taken in a tree-hole.

GOULD (G. E.) & DEAY (H. O.). **Notes on the Bionomics of Roaches inhabiting Houses.**—*Proc. Indiana Acad. Sci.* **47** pp. 281-284, 2 refs. Indianapolis, 1938.

Brief notes are given on the habits of the six species of cockroaches that have been taken in houses in Indiana. These are *Blattella germanica*, L., which is the commonest, *Periplaneta americana*, L., *P. fuliginosa*, Serv., *Blatta orientalis*, L., *Supella supellectilium*, Serv., and *Parcoblatta pensylvanica*, DeG.

MORISITA (T.). **Transmission Experiments on Relapsing Fever with Tropical Rat-mite, *Liponyssus* sp.**—*Jap. J. exp. Med.* **16** no. 6 pp. 551-558, 8 refs. Tokyo, 1938.

An account is given of experiments carried out in Tokyo on the transmission of *Spirochaeta (Borrelia) duttoni* from infected to healthy mice by means of a species of *Liponyssus* (either *L. nagayoi*, Yam., or *L. bacoti*, Hirst). Spirochaetes were found in protonymphs between 6 hours and 4 days after the infecting feeds and in adult mites between 6 hours and 7 days after them. Suspensions of protonymphs were

inoculated intraperitoneally into healthy mice at intervals of from 6 hours to 20 days after the infecting feed, and spirochaetes were observed in the blood of those mice inoculated with batches at intervals ranging from 6 hours to 5 days. Two mice inoculated with batches on the 8th day died 6 and 7 days, respectively, after the inoculation, but in neither case were spirochaetes seen in their blood. Batches of adult mites were inoculated into mice at similar intervals, and spirochaetes were observed in the blood of those mice inoculated at intervals ranging from 6 hours to 7 days. One mouse inoculated on the 8th day and two on the 10th day died 4, 3 and 1 days, respectively, after the inoculation, but spirochaetes were not seen in their blood. On the other hand, inoculation of suspensions of mites that had fed previously on healthy mice did not produce fatal results under similar conditions. Two series of experiments in which attempts were made to transmit the spirochaete by the bites of protonymphs or adult mites gave negative results. Eggs and larvae derived from an infected female mite did not contain spirochaetes.

KIRK (R.). A laboratory Study of Abyssinian Louse-borne Relapsing Fever.—*Ann. trop. Med. Parasit.* **32** no. 4 pp. 339–356, 1 pl.

1 fig., 39 refs. Liverpool, 1938. **The Non-transmission of Abyssinian Louse-borne Relapsing Fever by the Tick *Ornithodoros savignyi* and certain other blood-sucking Arthropods.**—*T.c.* pp. 357–365, 34 refs.

In the course of the investigations described in the first paper on a strain of relapsing fever found in the Sudan in immigrants from Abyssinia, a study was made of lice [*Pediculus humanus*, L.] from infected persons. A method of demonstrating spirochaetes in infected lice is described. Most commonly 15–20 per cent. of the lice proved to be infected. In 30 per cent. of the cases, no infected lice were found. Microscopic examination of crushed eggs, including a number deposited in captivity by infected lice, revealed no evidence of hereditary transmission. The spirochaetes in the lice were motile and reproduced the disease when inoculated into monkeys. The haemo-coelic fluid of a single louse from an infected person mixed with distilled water and rubbed into a small scarified area on the shaved abdomen of a splenectomised monkey produced a fatal infection.

In the second, an account is given of experiments undertaken with the same strain of louse-borne relapsing fever to determine whether it could persist in and be transmitted by the tick, *Ornithodoros savignyi*, Aud. [cf. *R.A.E.*, B **25** 153]. The ticks were allowed to bite infected persons or animals, and after various intervals attempts were made to transmit the infection to susceptible monkeys by the bites of the ticks, by inoculation of their coxal fluid, or by inoculation of a filtered suspension of their total contents in saline. The results were all negative, although a variety of strains derived in various ways from the original one were used. Spirochaetes were never found in the experimental animals, although their blood was examined daily during the experiment and for 20 days after the last attempt was made to infect them, and although they were later shown to be susceptible by inoculation of infected blood. Spirochaetes were not seen in the coxal fluid exuded by the ticks or in stained smears from their tissues. It was observed that a certain number of ticks died 2–3 days after a meal of infected blood; spirochaetes, similar in appearance to those

found in the blood, were always seen in the gut of these ticks after death, and in cases where dark-ground examinations were made, they were always motile.

Negative results were obtained when a suspension of 8 examples of *Argas persicus*, Oken, that had fed on an infected monkey was inoculated into mice and when suspensions of lice (*Pedicinus*) from infected monkeys were inoculated into a gerbille and a splenectomised monkey.

Ho (Ch'i). **On a Collection of Anopheline Mosquitoes from the Island of Hainan.**—*Ann. trop. Med. Parasit.* **32** no. 4 pp. 387-411, 16 figs., 31 refs. Liverpool, 1938.

The Anophelines collected in 1934 during a tour in the Island of Hainan, where malaria is very prevalent [cf. R.A.E., B **20** 238], were *Anopheles sintonoides*, Ho [**27** 63], *A. hyrcanus sinensis*, Wied., *A. h. nigerrimus*, Giles, *A. barbirostris*, Wulp, *A. kochi*, Dön., *A. minimus*, Theo., *A. jeyporiensis* var. *candidiensis*, Koidz., *A. vagus*, Dön., *A. philippinensis*, Ludl., a single female tentatively identified as *A. subpictus* var. *indefinitus*, Ludl., and *A. maculatus* var. *hanabusai*, Yam., which resembles the form from Formosa and is considered by the author to be a valid variety [cf. **14** 13; **19** 206; **20** 217]. Notes are given on the breeding places of these species and on the morphology of the adults and, in some cases, of the larvae and pupae. The characters distinguishing *A. h. sinensis* from *A. h. nigerrimus*, based on specimens taken in Hainan, are shown in a table. *A. minimus* and *A. vagus* were the only Anophelines found in dwellings, the latter being invariably the more abundant; together they represented more than 90 per cent. of the mosquitos caught in houses in hilly regions, but several Culicines predominated in houses in the plains.

DAVEY (T. H.) & GORDON (R. M.). **The Size of Aperture necessary in Screen cloth intended for the Protection of Dwellings in West Africa.**—*Ann. trop. Med. Parasit.* **32** no. 4 pp. 413-424, 3 figs., 10 refs. Liverpool, 1938.

In view of the doubt as to the effectiveness of screencloth of wire of no. 30 Imperial Standard Wire Gauge with 14 meshes to the linear inch in excluding species of *Anopheles* [cf. R.A.E., B **26** 39], the experiments described were carried out in Sierra Leone with screencloths of wire of no. 30 S.W.G. with 14, 16 and 18 meshes to the linear inch and of no. 28 S.W.G. with 16 meshes. The more important experimental work previously published on this subject is discussed and the results are shown in a table.

The following is substantially the authors' summary: The experiments were carried out with some 16,000 local mosquitos. *A. gambiae*, Giles, and *A. funestus*, Giles, were able to pass through a screencloth with apertures of 0.059 inch in diameter, while *A. funestus* sometimes escaped through apertures as small as 0.050 inch in diameter. These experiments appear to show that the size of aperture advisable for screening houses against Anophelines in West Africa must not exceed 0.047 of an inch, which is represented by a standard screencloth of mesh 16×16, composed of wire of 28

S.W.G. Experiments with *Aedes vittatus*, Big., and *A. simpsoni*, Theo., proved that they can penetrate through wire-gauze apertures of 0.059 inch; they were not tested with smaller apertures.

Observations on the method by which mosquitos squeeze their way through narrow apertures suggested that their ability to do so is directly dependent on the dorso-ventral diameter of the thorax.

WHEELER (C. M.). Relapsing Fever in California. Attempts to transmit Spirochaetes of California Relapsing Fever to Human Subjects by means of the Bite of the Vector, *Ornithodoros hermsi* Wheeler.—*Amer. J. trop. Med.* **18 no. 6 pp. 641–658, 1 pl., 3 diagr., 1 map, 12 refs. Baltimore, Md., 1938.**

After reviewing the work that has been carried out on the transmission of Californian relapsing fever in the United States, particularly transmission by means of the tick, *Ornithodoros hermsi*, Wheeler, to mice and monkeys [cf. *R.A.E.*, B **23** 221; **24** 207], the author describes experiments in which adult and nymphal ticks, known to be infective, were fed on six men. Five of them did not become infected, but one, on whom two female ticks had fed, contracted the disease 7 days later, and since no coxal fluid or faecal material was exuded during feeding or immediately after detachment, infection must have been transmitted through the mouth-parts of the tick. These tests show that all persons are not susceptible to the disease, a fact that probably explains the comparatively few cases of relapsing fever reported annually from California. The wounds caused by the insertion of the mouth-parts of the ticks are scarcely noticeable, and little or no sensation is experienced at the time of attachment, during the feeding or at any time following the detachment of the tick; moreover, the wounds tend to disappear within a week. These findings, together with the fact that ticks of the genus *Ornithodoros* usually feed at night, undoubtedly account for the number of cases in which no history of tick bite is recorded.

CHUNG (Huei-lan) & WEI (Yü-lin). Studies on the Transmission of Relapsing Fever in North China. II. Observations on the Mechanism of Transmission of Relapsing Fever in Man.—*Amer. J. trop. Med.* **18 no. 6 pp. 661–674, 2 figs., 13 refs. Baltimore, Md., 1938.**

The authors describe further experiments carried out in Peiping [cf. *R.A.E.*, B **25** 98] to determine the way in which the Chinese strain of *Spirochaeta (Borrelia) recurrentis* is transmitted to man by lice [*Pediculus humanus*, L.]. The results indicate that it is not transmitted by biting and that the faeces of lice are not infective, but that it is contracted by crushing infected lice on skin slightly traumatised by such means as louse bites and scratching, or by receiving infective material on the conjunctivae [cf. *I* 72, 235]. No transmission took place when large numbers of spirochaetes in the plasma of blood from an infected person or in the haemocoelic fluid of lice were held in contact with the whole skin overnight, or through the mucous membranes of the mouth when suspensions of spirochaetes from lice were instilled into the oral cavity.

BOYD (M. F.) & KITCHEN (S. F.). **The clinical Reaction in vivax Malaria as influenced by the consecutive Employment of infectious Mosquitoes.**—*Amer. J. trop. Med.* **18** no. 6 pp. 723-728, 2 refs. Baltimore, Md., 1938.

The authors give data obtained from 116 cases in which batches of 1-5 or 6-10 Anophelines infected with [*Plasmodium*] *vivax* were applied consecutively to several persons, since these appear to have a bearing on the problem of sporozoite dosage as a factor in determining the durations of the incubation period and the clinical attack in man [cf. *R.A.E.*, B **21** 182; **25** 231].

The following is taken largely from their discussion : When small batches of mosquitos were used, the proportion of cases in which the incubation period was long and the duration of the attack less than 8 days was higher among patients to whom the mosquitos were applied last than among those to whom they were applied first. These differences are attributed to a diminution of the sporozoite dosages received by the last patients, which was due partly to the death of some of the mosquitos in the batch, but more especially to a depletion of the sporozoites. When larger numbers of mosquitos were used, such variations were not observed, probably because the last patients still received considerably more than the minimum infecting dose of sporozoites. When a moderate number of infected mosquitos are applied, the duration of the clinical attack tends to vary inversely with the duration of the incubation period. Attacks of less than 8 days duration may be as indicative of inadequate inoculation as of immunity, and to a high degree they are associated with normal incubation periods of 15 days or longer.

WOOD (S. F.). **A new Locality for *Trypanosoma cruzi* Chagas in California.**—*Science* **87** no. 2260 pp. 366-367, 2 refs. New York, N.Y., 1938.

In August 1937, 12 of 24 adults and 45 of 128 nymphs of *Triatoma protracta*, Uhler, taken in nests of wood rats [*Neotoma* spp.] in Los Angeles County, California, harboured a trypanosome that was found by intramuscular inoculation of faeces of the infected bugs into two healthy females of *Peromyscus californicus insignis*, to be a non-virulent form of *Trypanosoma cruzi* [cf. *R.A.E.*, B **26** 144]. Examination of the faeces of two healthy adults and two nymphs of *T. protracta* allowed to feed on the 19th day on one of the infected mice showed heavy infections with crithidias and trypanosomes 53 days later, while three nymphs allowed to feed on the 13th day on the other infected mouse showed faecal infections after 56 days.

EWING (H. E.). **Occurrence of the Oriental Rat Flea in the Interior of the United States.**—*Science* **88** no. 2288 p. 427, 2 refs. New York, N.Y., 1938.

ROUDABUSH (R. L.). **Survival of the Tropical Rat Flea in United States.**—*Op. cit.* **89** no. 2300 pp. 79-80, 2 refs. 1939.

In the first paper, records of *Xenopsylla cheopis*, Roths., from Iowa [cf. *R.A.E.*, B **22** 164] and Minnesota [**25** 58] are recapitulated, and two further records of the occurrence of this flea are given, one of 11 females and 6 males taken in elevator refuse in December 1937 at Urbana, Illinois, and another of 3 females and 3 males taken in

August 1938 in an office at Youngstown, Ohio. It is suggested that a race of the flea that is resistant to a temperate climate has been developed in some of the northern ports, such as New York and Boston, and has spread from them to the central States.

In the second paper, it is stated that collections of fleas at Ames, Iowa, from 1934 to 1938 show that *X. cheopis* is established, and does not migrate annually into the interior of the United States. Its spread into the interior could have been more easily accomplished by shipping on the Mississippi than by cross-country migration from New York or Boston. In temperate zones, the flea may very well survive in the warm environment provided by the tunnels of rats, since in them it is not influenced by external temperatures.

WHEELER (C. M.). Experimental Infection of *Ornithodoros turicata* (Duges) with a Brazilian Strain of *Trypanosoma cruzi* Chagas.—*Proc. Soc. exp. Biol.* **38 no. 2 pp. 191–193, 1 ref. New York, N.Y., 1938.**

Of 30 uninfected larvae of *Ornithodoros turicata*, Dugès, reared in the laboratory from an uninfected female taken in Texas in 1937 and allowed to feed on 20th August on a mouse that had been infected with a Brazilian strain of *Trypanosoma cruzi*, five moulted to the nymphal stage on 1st September, the others dying in the process. They appeared to have passed through two larval instars. The nymphs refused to feed a week later on a normal mouse, but when a suspension of three of them was inoculated intraperitoneally into two healthy mice, *T. cruzi* was present three weeks later in the blood of both. Similar feeding and inoculation tests with *O. hermsi*, Wheeler, have given negative results.

BERBERIAN (D. A.). Successful Transmission of Cutaneous Leishmaniasis by the Bites of *Stomoxys calcitrans*.—*Proc. Soc. exp. Biol.* **38 no. 2 pp. 254–256, 6 refs. New York, N.Y., 1938.**

The author criticises the hypothesis that cutaneous leishmaniasis is in nature transmitted to man by sandflies (*Phlebotomus* spp.), since experiments to demonstrate transmission by bite have given negative results, and even if infection were possible by crushing an infected sandfly on the site of a bite, this is very difficult to do. There is no evidence that sandflies are preferentially attracted to lesions for feeding and even if they fed on a lesion, it is unlikely that they would ingest the endothelial tissue that harbours *Leishmania tropica*. Furthermore, only 25 per cent. of females of *P. sergenti*, Parr., and *P. papatasii*, Scop., infected on their first bite, and hardly any infected on the second or third, would survive for the period of 6–8 days necessary for *L. tropica* to become infective.

In preliminary experiments at Beirut, Lebanon, on the possibility of mechanical transmission by blood-sucking flies, 7 females of *Stomoxys calcitrans*, L., were allowed to feed during July 1937 on a lesion induced on the arm of the author by inoculation of a culture of *L. tropica*, and immediately transferred to the thigh of a volunteer, which was bitten, in all, 11 times. Two lesions appeared on the site of the bites 5 and

6 months later, and a smear from the first lesion showed numerous Leishman-Donovan bodies. The author considers that mechanical transmission by *Stomoxys* frequently occurs in nature.

CAMERON (J. W. M.). **The Reactions of the Housefly, *Musca domestica* Linn., to Light of different Wave-lengths.**—*Canad. J. Res. (D)* **16** no. 11 pp. 307-342, 1 pl., 22 figs., 102 refs. Ottawa, 1938.

The following is taken largely from the author's abstract : Houseflies (*Musca domestica*, L.) were reared on an artificial medium and tested with different wave-lengths of spectral light obtained from a quartz-mercury arc : the comparison standard in all cases was white light. Flies to be tested were removed from the breeding cage ten hours before tests began and were kept in darkness until used. Each fly of which the record was used in compiling the final results was caused to make ten trips towards the two test lights, and a record was kept of the choice on each trip. A description and discussion of the four different methods found in the literature for conducting experiments of this type, and for analysing the results, are included. Application of three of the methods to the same data shows that they give results that vary greatly as the intensity changes. Some show that efficiency increases as the intensity increases, while others show a decrease in efficiency with increasing intensity. If the intensities of all coloured lights are equal, the three methods give practically the same qualitative results when applied to the same data. That is, a curve of efficiency is found which has its peak at the same wavelength, whatever method is used. Quantitatively, the results given by the three methods differ, so that no definite ratio of attractiveness can be determined between colours. The data obtained were not amenable to analysis by the fourth method, but published results indicate that this is perhaps the best method for determining the quantitative relations between the stimulative efficiencies of light of different colours.

The house-fly is much more strongly stimulated by ultra-violet light of wave-length 3656 Å than by any other part of the spectrum examined. The effect decreases, at first rapidly and then more slowly, as the longer wave-lengths are reached ; it also decreases on the short-wave side of the peak. The spectrum available extended only as far as λ3022 Å in the ultra-violet, at which point there was still an appreciable attractiveness, apparently greater than that of either yellow or green.

LÖRINCZ (F.) & MIHÁLYI (F.). **Untersuchungen über die hygienische Bedeutung der Fliegenfrage in Ungarn.** [Investigations on the hygienic Importance of the Fly Problem in Hungary.] [*In Magyar.*]—*Állat. Közlem.* **35** no. 1-2 pp. 1-13, 7 refs. Budapest, 1938. (With a Summary in German.)

Investigations in Hungary in 1936 [cf. *R.A.E.*, B **24** 281] showed that 95 per cent. of the flies taken on human faeces were, in descending order of abundance, *Fannia scalaris*, F., *Muscina stabulans*, Fall., *Sarcophaga haemorrhoalis*, F., *Hylemyia (Paregle) cinerella*, Fall., and *Musca domestica*, L. The commonest flies visiting foodstuffs were *M. domestica* and *Fannia canicularis*, L., followed by *Calliphora erythrocephala*, Mg., *F. scalaris*, *Drosophila funebris*, F., *D. fasciata*, Mg., and *M. stabulans*. In addition to these, *Lucilia caesar*, L., was taken on fruit in shops. The most numerous fly in houses was *M. domestica*.

JANJUA (N. A.). *Lucilia sericata* Meigen, in Baluchistan.—*Curr. Sci.* **6** no. 9 p. 456, 1 ref. Bangalore, 1938.

Several examples of *Lucilia sericata*, Mg., were taken in 1933 near Quetta from the carcass of a dead sheep. This is the first record of the fly from Baluchistan.

PEMBERTON (C. E.). Hornfly Enemy.—*Rep. Comm. Exp. Sta. Hawaii Sug. Pl. Ass. 1938* p. 24. Honolulu, 1938.

Two examples of the Hydrophilid, *Sphaeridium scarabaeoides*, L., were taken on Oahu in October 1937. This is the first time that this predatory beetle has been observed since it was introduced from Germany into Hawaii in 1909 for the control of the hornfly [*Lyperosia irritans*, L.].

MACFARLANE (W. V.). Blowfly Strike in Marlborough. Incidence and Control Discussed.—*N.Z. J. Agric.* **57** no. 5 pp. 388–389, 391–392, 2 figs. Wellington, N.Z., 1938.

Investigations on infestation of sheep by blowflies in the Marlborough Province of New Zealand were undertaken in consequence of a severe outbreak in this area in the spring, summer and autumn of 1935–36. Although a great deal of work on the causes of such infestation has been carried out in other countries, no general account has been given of the position in New Zealand, and the results of the investigations in Marlborough are therefore reviewed. Adults reared from maggots found on sheep were nearly all those of *Calliphora laemica*, White [cf. *R.A.E.*, B **25** 282], but about 5 per cent. were *Lucilia sericata*, Mg.; females of *Chrysomyia rufifacies*, Macq., and *Ophyra analis*, Macq., were rarely found to have deposited eggs on sheep both as primary and secondary flies. Succession of flies in a lesion is unusual in New Zealand. Susceptibility to crutch strike was found to be produced by urine-staining or occasionally by grass scour; when the skin is wetted, it becomes irritated and finally breaks down, and the decaying skin, serum and pus combined with the urine attract ovipositing females. In 33 per cent. of the cases examined, urine-staining was due to medial crutch wrinkles, which collect sweat, suint and urine, and in 54 per cent. of the cases, to malformation of the vulva. Scourings rarely attract flies unless there is urine-staining as well. Back strike is of greater importance in New Zealand than in Australia, and, compared with crutch strike, the lesions are more extensive, the mortality is higher and control is more difficult. Strikes on wrinkled tails in Merino sheep and on rams' heads behind the horns are localised forms of back strike. Susceptibility to this type of strike is determined by type of wool, rainfall, temperature and density of fly population. Heavy autumn rains falling for 5 or more consecutive days, such as occurred in February and April 1938, cause irritation of the skin and attraction of flies; if the fleece is dense the moisture is retained, and the high humidities experienced in autumn delay evaporation. The rain apparently causes the breaking down of the yolk and of the surface layers of the skin, and gives rise to attractive compounds similar to those occurring in urine-staining, and the dermatitis is followed by a growth of bacteria, some of which may produce discolouration. This fleece rot

usually marks the period of wetting of the wool and does not necessarily attract flies at a later date, so that it appears to be due to the same set of conditions as fly strike and may be regarded as an indication of susceptibility during a rainy season rather than a cause of strike.

Tests indicated that trapping as a control measure against blowflies would not at present be economically justifiable. Crutching and shearing are effective in checking crutch strike. Crutching should be done early (at the end of December or early January) and should be repeated every two months, or, in some years, once a month. Jetting with a 1 per cent. solution or suspension of arsenic gave protection for about the same length of time as crutching, and the procedure is quicker and easier. Jetting the backs of sheep with a suspension of calcium arsenite (1 per cent. arsenious oxide) caused no noticeable damage to wool or skin and prevented infestation; nearly half the arsenic was present two months later. Strike is commonest on the neck, withers, rump and tail and on the heads of rams, and the suspension should be applied most thoroughly to these regions. This measure should not be used on sheep that have already been infested, because of the probable absorption of arsenic through the broken skin. Medial crutch wrinkles and tail wrinkles may be removed with secateurs or may be reduced by selective breeding, but it is not yet known whether malformations of the vulva are hereditary and therefore also eradicable by selective breeding.

KÉLER (S.). *Ueber einige neue und interessantere Mallophagen des Deutschen Entomologischen Instituts in Berlin-Dahlem.* [On some new and more interesting Mallophaga in the Deutsches Entomologisches Institut in Berlin-Dahlem.]—*Arb. morph. taxon. Ent. Berl.* **4** no. 4 pp. 312–324, 3 figs. Berlin, 1937.

WERNECK (F. L.). *Sobre os mallophagos da cabra, do cavalo e do jumento.* [On the Mallophaga of the Goat, Horse and Donkey.]—*Mem. Inst. Osw. Cruz* **33** fasc. 3 pp. 395–401. Rio de Janeiro, 1938.

The second paper is a criticism of the nomenclature adopted in the first as regards the Mallophaga that attack goats, horses and donkeys.

DEVIGNAT (R.). *L'utilisation du milieu de Broquet pour la recherche de la peste des puces. (Note complémentaire.)*—*Ann. Soc. belge Méd. trop.* **18** no. 4 pp. 543–545, 3 refs. Brussels, 1938.

Further strains of plague have been isolated in the Belgian Congo from examples of *Xenopsylla brasiliensis*, Baker, *Ctenocephalides (Ctenocephalus) canis*, Curt., and species of *Sarcopsylla* and *Ctenophthalmus* that have been preserved in Broquet's medium for from 1 to 6 days [cf. *R.A.E.*, B **26** 255].

DUREN (A.). *Etat actuel de nos connaissances sur les anophèles du Congo belge.*—*Ann. Soc. belge Méd. trop.* **18** no. 4 pp. 557–580, 5 maps, 13 refs. Brussels, 1938.

A list is given of the 32 species and 6 varieties of Anophelines that had been recorded from the Belgian Congo and Ruanda-Urundi up to 1938, together with information taken from the literature on their density, on the rate of infection of the principal species with oöcysts

and sporozoites of malaria parasites, and on the local distribution of each species, and, where possible, on its bionomics in the Belgian Congo. Only *Anopheles gambiae*, Giles, *A. funestus*, Giles, *A. moucheti*, Evans, *A. nili*, Theo., *A. rufipes*, Gough, and *A. pharoensis*, Theo., have been found infected with malaria parasites, and the last two are so relatively rare that they are of little importance in the transmission of malaria.

La transmission du paludisme par les diverses espèces d'anophèles égyptiens.—*Bull. Off. int. Hyg. publ.* **30** no. 12 pp. 2789-2792, 9 refs. Paris, 1938.

A list is given of the Anophelines recorded from Egypt [cf. *R.A.E.*, B **13** 125; **19** 173; **22** 39; **27** 120]. Those taken in the Nile Valley were *Anopheles pharoensis*, Theo., *A. multicolor*, Camb., *A. coustani*, Lav. (*mauritanus*, Grp.) and *A. sergenti*, Theo. The numbers of these species found in a collection of 4,594 larvae were 2,650, 1,332, 446 and 166, respectively, and in a collection of 3,595 adults taken in houses and stables 3,084, 10, 447 and 164. Their relation to malaria is discussed, chiefly from the literature. *A. pharoensis* has been found naturally infected and is a vector [cf. **14** 14; **26** 49, etc.]. It was the only Anopheline present at Gabares during an epidemic in 1933. *A. multicolor* has not been found infected in nature, and the part it plays in transmission is doubtful [cf. **24** 295]. *A. sergenti* was easily infected at the Research Institute, Cairo, in 1934, and in the course of a malaria survey made by the Institute at Ibschwaï (Fayyum) in 1933, it was found in a police post where most of the men had contracted malaria; of 35 females dissected, 3 harboured ripe oöcysts. It is suspected on epidemiological grounds of being a vector, although no sporozoites have yet been found in it. Attempts to infect 35 examples of *A. coustani* at the Institute in 1934 gave negative results. It is usually found in stables, but also enters dwellings and bites man, and the part it plays in transmission is doubtful.

CORRADETTI (A.). Epidémiologie du paludisme dans la région du Lac Tsana.—*Bull. Off. int. Hyg. publ.* **30** no. 12 pp. 2793-2795. Paris, 1938.

Le paludisme dans la région Uollo-Jeggiu (Ethiopie) pendant la saison des pluies.—*T.c.* pp. 2796-2799.

The first paper is a report of investigations on the epidemiology of malaria in the vicinity of Lake Tsana carried out from 18th April to 5th May 1938. The larvae found were those of *Anopheles cinereus*, Theo., *A. pretoriensis*, Theo., *A. demeilloni*, Evans (*transvaalensis*, auct.), and *A. coustani*, Lav. (*mauritanus*, Grp.), and some others thought to be those of an undescribed variety of *A. longipalpis*, Theo. The first three species are of no importance in the transmission of malaria, but *A. coustani* is suspected of being a vector. The author considers that definite information on the incidence of malaria and its vectors in this region can be obtained only by investigations during the rainy season.

The second paper is an account of Corradetti's investigations on Anophelines and malaria near Dessie [cf. *R.A.E.*, B **26** 183, 215].

OLIN (G.). **Etudes sur l'origine et le mode de propagation de la tularémie en Suède.**—*Bull. Off. int. Hyg. publ.* **30** no. 12 pp. 2804–2807, 4 réfs. Paris, 1938.

A further outbreak of tularaemia occurred in the department of Gävleborg, Sweden, in July, August and September 1938 [cf. R.A.E., B **27** 95]. More than 200 persons became infected, and although hares and other rodents seem to have played an essential part as the source of the disease, direct contact with them was not apparently the means of infection. Mosquitos were again suspected of being the vectors [cf. loc. cit.], since they were the most numerous biting insects at the time the two epidemics occurred, and the primary lesions in man were always found on parts of the body most exposed to the attacks of biting insects. About 50 examples of *Aëdes cinereus*, Mg., collected towards the end of the epidemics in a locality where more than 50 human cases had occurred were made into a suspension and injected subcutaneously into two guineapigs, both of which became infected. *Bacterium tularensis* was isolated from their spleens and blood. Lemmings were numerous in 1938, and a study carried out in Swedish Lapland showed that they also harboured *B. tularensis*, which caused a high mortality among them [cf. **19** 66]. About 60 cases of tularaemia occurred in man in this region, and mosquitos were numerous during the summer.

MOREAU (P.). **Valeur des pulvérisations insecticides dans la lutte anti-malarienne.**—*Rev. méd. franç. Extr.-Orient.* **16** no. 3 pp. 264–274, 2 figs., 7 refs. Hanoi, 1938.

The author discusses the value of spraying against adult Anophelines in houses [cf. R.A.E., B **24** 191]. The first experiments in Indo-China in 1935 gave satisfactory results, but the practical application of the measure was limited by the cost of the insecticide used, the difficulty of finding a satisfactory spraying apparatus of French make, and the fact that all pagodas and most of the native dwellings are lit, often both night and day, by small oil lamps with naked flames, so that the use of insecticides with mineral oil bases was precluded by the danger of fire. However, a French firm then produced a concentrated extract of pyrethrum, containing 5·5 per cent. pyrethrins, which when diluted with water gives a "pseudosolution" that is homogeneous and easy to spray. An account is given of investigations on this material carried out over a period of 7 months at Hué, Annam. Laboratory experiments confirmed the observation of Sinton & Watts that spraying is more effective when the temperature is high and the humidity low [**23** 301]. Experiments were subsequently carried out in a native dwelling on the edge of a canal, where it was possible at nightfall for two workers to catch about 100 adults of the genera *Culex* and *Anopheles* in an hour. The optimum dilution of the insecticide appeared to be 1 per cent., and the house could be kept free from mosquitos by a daily application (at 5 o'clock) of a spray at this dilution at the rate of 1 fl. oz. to 200 cu. ft. It was possible to pass the night in the house without being bitten after the second application, and attempts to catch adults on subsequent nights were consistently negative. The apparatus and technique used for spraying are described. It is thought that the extract acts both by killing and by repelling the mosquitos. It is

concluded that the measure is both economical and effective, and its use is recommended when it is necessary to break quickly a temporary contact between an aggregation of men and an Anopheline fauna consisting of malaria vectors that are domestic and anthropophilous, such as occurs in sudden epidemic outbreaks of malaria or on the introduction of a group of susceptible men into a hyperendemic area.

WEYER (F.). Die Malaria-Ueberträger. [The Vectors of Malaria.]—
Super roy. 8vo, 141 pp., 15 figs., 8 pp. refs. Leipzig, G. Thieme,
1939. Price, paper Mk. 8·40, bound 9·80, less 25 per cent. abroad.

This survey of the species of *Anopheles* that have been recorded as natural or experimental vectors of malaria contains a section in which are discussed the factors to be considered in pronouncing a species dangerous, a second in which the more important vectors are recorded under countries or states, a third in which notes on distribution, breeding places, habits, and relation to malaria are given for 46 species, including the principal vectors, followed by another containing similar information for 24 species of minor importance or of which the relation to malaria is still undefined, and a list of the 19 most important vectors, showing their distribution.

PATIÑO CAMARGO (L.). Notas sobre fiebre amarilla en Colombia.
[Notes on Yellow Fever in Colombia.]—Rev. Fac. Med. Bogotá
6 no. 5 repr. 74 pp., 4 maps, 115 refs. Bogotá, 1937. [Reed.
1939.]

In the course of this comprehensive review of knowledge of yellow fever in so far as it concerns Colombia, the author gives lists of 117 species of mosquitos and 35 species of other Arthropods recorded in the medical literature of the country, and points out that of the species of mosquitos that have been shown to transmit the disease by biting, *Aëdes aegypti*, L., *A. scapularis*, Rond., *A. taeniorhynchus*, Wied., *A. fluvialis*, Lutz, and *Culex fatigans*, Wied. [cf. R.A.E., B **18** 166; **19** 108; **21** 263] are the ones that have been found there.

ROUBAUD (E.). La transmission de la fièvre jaune dans les pays extra-tropicaux.—Conf. int. Prot. Calamités nat. **1** (1937) pp. 355–358.
Paris, Comm. franç. Etudes Calamités, 1938.

The author discusses the transmission of yellow fever, particularly with regard to the possibility of the virus being introduced into Europe, as laboratory work has shown that it may be experimentally transmitted by *Aëdes geniculatus*, Oliv. [R.A.E., B **25** 201], a mosquito found in the forest regions of cold and temperate parts of the continent.

ROUBAUD (E.) & COLAS-BELCOUR (J.). Comportement des oeufs de l'Aëdes geniculatus Oliv. soumis aux influences alternantes d'humidité et de sécheresse, en conditions naturelles et expérimentales.—Bull. Soc. Path. exot. **31** no. 10 pp. 924–929, 1 graph, 10 refs. Paris, 1938.

Details are given of observations and experiments carried out with material collected in Normandy, which show not only that the eggs of *Aëdes geniculatus*, Oliv., are resistant to prolonged periods of dryness, but also that after being subjected to dryness they do not all hatch

at the time of the first immersion of the medium containing them. The eggs not affected may hatch on immersion after one or more subsequent periods of dryness. This may bring about the overlapping of several generations of the mosquito, since new eggs may be laid in the same place as unhatched eggs of preceding generations. Development from egg to adult occupied an average of 21 days at a temperature of about 20°C. [68°F.].

KOMP (W. H. W.). *Aëdes leucotaeniatus*, a new Species of *Aëdes* allied to *A. leucocelaenus* D. & S.; and Descriptions of the Male and Larva of *A. leucocelaenus* D. & S. (Diptera, Culicidae).—*Proc. ent. Soc. Wash.* **40** no. 9 pp. 260–266, 6 figs., 7 refs. Washington, D.C., 1938.

Descriptions are given of the male terminalia of *Aëdes leucocelaenus*, Dyar & Shannon, from Brazil, Argentina, Colombia and British Guiana, and of the female and the male terminalia of *A. leucotaeniatus*, sp. n., from the Panama Canal Zone. *A. leucotaeniatus* is the species previously recorded as *A. leucocelaenus* from Panama [cf. *R.A.E.*, B **13** 168]; the latter is known only from South America. The larva of *A. leucocelaenus* is also described; that of *A. leucotaeniatus* is unknown.

FRANCIS (E.). Longevity of the Tick *Ornithodoros turicata* and of *Spirochaeta recurrentis* within this Tick.—*Publ. Hlth Rep.* **53** no. 51 pp. 2220–2241, 3 pls., 3 figs., 3 charts, 20 refs. Washington, D.C., 1938.

An account is given of laboratory observations extending over 7 years on 119 examples of *Ornithodoros turicata*, Dugès, collected in two caves in Texas in 1931 and naturally infected with a spirochaete of relapsing fever, here called *Spirochaeta recurrentis* [but cf. *R.A.E.*, B **22** 106, 246, etc.]. The types of cave in which ticks were collected are described. Each of the two batches of ticks (consisting of 80 and 39 individuals, respectively) was fed on a monkey (*Macacus rhesus*), and both monkeys became infected. The ticks were then starved for 3, 4 or 5 years, and 64, 35 and 13 survived; 3 healthy monkeys were infected by the batches of 12, 11 and 13 ticks that were fed at the end of these periods. Five females of the first batch failed to infect a healthy monkey when fed again after a further period of 3 years, but 5 of the second batch fed again after 2½ years transmitted the infection; ticks of the third batch are to be fed again in 1939. Unfed larvae from the naturally infected ticks transmitted the infection when injected subcutaneously into mice. Larvae and first-instar nymphs that were allowed to feed on mice but failed to transmit the infection were fed in subsequent stages on infected animals. Their offspring transmitted the spirochaete by biting both as larvae and first-instar nymphs. Four mice became infected by ingesting bed-bugs (*Cimex lectularius*, L.) that had had 4, 2 and 1 infecting feeds, but 4 other mice that also ingested bugs did not become infected. *Spirochaeta morsus-muris* was not transmitted in this way. Spirochaetes could not be demonstrated in monkey lice (*Pedicinus longiceps*, Piaget) for the first 16 days after the date of infection of the monkey on which they were living, but were seen daily from the 17th to the 21st day; lice taken from this monkey on the 21st, 28th and 36th day and placed on a normal monkey failed to transmit the disease.

Ticks that engorged in September, October or November oviposited in the following May, whereas ticks that engorged in April or May oviposited, respectively, 20 and 9 days later. Development from egg to adult occupied just over 9 months in the case of eggs deposited in June. There are usually 4 nymphal instars, though 3 and 5 have been observed. The last male tick died after 6 years and 8 months, but 14 females were living at the end of 7 years. Three females were living 24 months after oviposition. Spirochaetes were not observed in coxal fluid excreted at the time of feeding, or in mice into which coxal fluid was injected. Five males and 5 females survived continuous submersion in distilled water for a week without ill effects. In the absence of moisture, 13 out of 445 infected larvae fed on 20th-21st June survived until 11th November; 359 infected first-instar nymphs fed on 22nd June were all dead on 16th March following; and of 12 males and 16 females recently fed, one male and one female survived from July 1937 to March 1938. The methods and apparatus used for feeding ticks on animals and for making dark-field examinations of blood are described.

BONÉ (G.). L'excrétion des spirochètes de Dutton chez *Ornithodoros moubata*. —*C. R. Soc. Biol.* **130** no. 1 pp. 84-85, 2 refs. Paris, 1939.
La transmission héréditaire du spirochète de Dutton chez *Ornithodoros moubata*. —*T.c.* pp. 86-87.

In these two papers, an account is given of further experiments on the behaviour of *Spirochaeta duttoni* in the tick, *Ornithodoros moubata*, Murr. [cf. *R.A.E.*, B **27** 111]. It has been shown that infection takes place through the coxal fluid [*loc. cit.*]. If, as most workers admit, this fluid is secreted by glands, the spirochaetes must traverse the walls of the glands and accumulate in the liquid in order to be excreted with it. However, in a paper on *Argas persicus*, Oken, already noticed [1 215], it was suggested that the coxal fluid is haemocoelic fluid filtered through a thin membrane of chitin, and that the spirochaetes pass through the membrane with the liquid. The presence in the first drop excreted of cells similar to the nucleated cells of the haemocoelic fluid, and the large amount of liquid that flows out in a few moments in the course of a meal would be more easily explained if there were no gland but an orifice connecting the general cavity with the exterior. Experiments were carried out in which liquid containing red corpuscles from sheep, microbes or spirochaetes was injected by means of a micropipette through the leg into the general cavity of ticks, which were immediately fed on healthy mice; or so much liquid was introduced in the same manner that liquid was excreted from the coxal orifices as a result of internal tension. Neither this liquid nor that excreted during the meal contained any of the bodies introduced, whereas it was easy to find them in the haemocoelic fluid from the end of any leg cut. If there were direct communication between the haemocoel and the exterior, not only should these bodies have been found, but the number of spirochaetes in the haemocoel of infected ticks should decrease during the course of the meal, whereas it has been shown that they increase [cf. **27** 111], although there is a decrease in those in the coxal fluid. The large numbers of spirochaetes found in the first drops of fluid excreted show that what is called the coxal gland constitutes a reservoir where the spirochaetes can accumulate and possibly multiply. The spirochaetes pass by an unexplained

tropism from the stomach to the haemocoel and from there to the coxal gland, and spirochaetes introduced directly into the haemocoel have never been found to migrate towards the stomach.

Eggs laid by ticks that had fed on infected mice were examined under an ultramicroscope. In the first experiment, no spirochaetes were seen in 40 eggs examined ; in the second, all the eggs laid by three females contained spirochaetes ; in the third, eggs laid by these same females after another infecting meal were all free from spirochaetes. The fact that spirochaetes were found in eggs that had just been laid indicates that the transmission of infection from adult to egg is by means of spirochaetes and not by an invisible or granular form of the parasite. All ticks are not hereditarily infected, and the negative results of experiments may be explained by the absence or rarity of parasites in the eggs examined. Injection into mice of 5-100 eggs freshly deposited by infected females resulted in the infection of 2 out of 7. Among those that remained uninfected was one into which 15 eggs containing about 1 spirochaete per field had been injected. It also seems probable that the other mice that remained uninfected had also received spirochaetes, since three healthy mice into which 1-10 larvae from eggs of the same batch were injected all became infected. It is possible that spirochaetes in the egg are less virulent, or that their being surrounded by the substances composing the egg renders them less likely to bring about infection.

GHIDINI (G. M.). Ditteri ematofagi dell'Africa Orientale Italiana. Gen. Tabanus (s.l.). [The Blood-sucking Diptera of Italian East Africa. Genus *Tabanus* (s.l.)—*Riv. Biol. colon.* 1 fasc. 5 pp. 321-364, 16 figs., 2 pp. refs. Rome, 1938. (With Summaries in English, French, German.)]

The literature on the part played by Tabanids as vectors of diseases of man and animals in various parts of the world is briefly reviewed, and a key is given to the species of *Tabanus* recorded in Italian East Africa, together with description of all the species, two of which are new, and notes on their local distribution.

JERACE (F.). I flebotomi degli Abruzzi. [Sandflies of Abruzzi.]—*Riv. Parassit.* 2 no. 4 pp. 339-347, 2 figs., 12 refs. Rome, 1938 ; *Ann. Igiene* 49 no. 1 pp. 11-14, 2 figs. Rome, 1939.

In the first of these two papers, *Phlebotomus perfiliewi*, Parr. (*macedonicus*, Adlr. & Thdr.), and *P. papatasii*, Scop., are recorded from the province of Pescara, Abruzzi, where cutaneous leishmaniasis is endemic [*cf. R.A.E.*, B 27 62]. *P. perfiliewi* was the more abundant. Recent descriptions of the two species [21 27 ; 22 3] are translated into Italian.

The second paper records the finding of *P. perfiliewi* and *P. perniciosus*, Newst., in the province of Terano in September 1938. Both sexes of *P. perniciosus* are described.

CORSON (J. F.). A fifth Note on the Infectivity to Man of a Strain of *Trypanosoma rhodesiense* : three further Passages through Antelopes and Tests on Man ; two Charts of the Whole Experiment.—*J. trop. Med. Hyg.* 42 no. 1 pp. 5-7, 1 ref. London, 1939.

Details are given of further experiments with the strain of *Trypanosoma rhodesiense* isolated in 1934 [*cf. R.A.E.*, B 27 18, etc.],

in which it was passed through three more antelopes by means of the bites of *Glossina morsitans*, Westw., and after each passage was successfully transmitted by this fly to one or more native volunteers. In the author's opinion, only positive results should be considered in estimating the infectivity to man of this strain of *T. rhodesiense*. It cannot be inferred from the resistance of some volunteers to infection that its infectivity to man has become less during maintenance for four years in ruminants and man.

Two charts are given showing the passages and tests on man from the beginning of the experiment in October 1934 up to October 1938.

KEMPER (H.). Versuche mit dem "Thermodes"-Heissluft-Entwesungsverfahren. [Experiments with the "Thermodes" Hot Air Disinfestation Process.]—*Z. hyg. Zool.* **31** pt. 2 pp. 33–44, 1 fig., 9 refs. Berlin, 1939.

Temperatures of 55°C. [131°F.] and over (which are fatal to insects that are household pests) can be obtained by means of the apparatus described, which is designed chiefly for use against *Cimex lectularius*, L. It is about 4 ft. high and is suitable for rooms of up to about 2,800 cu. ft. space. A conical casing encloses a heavy-oil burner and an electric motor working a compressor for circulating the air. The temperature is raised to about 55°C. in an hour, and during the last two or three hours of treatment, which lasts 6–8 hours, it reaches a maximum of about 80°C. [176°F.].

KONO (H.). On *Xanthochroa atriceps*, Lewis, a new Pest causing Eruptions on the Human Body. [In Japanese.]—*Oyo-Dobuts. Zasshi* **11** no. 1 pp. 10–14, 1 fig. Tokyo, 1939.

The Oedemerid, *Xanthochroa atriceps*, Lewis, which is described, is very common in Hokkaido and Sakhalin, the adults emerging in July and August. Their body-fluid causes blisters on tender skin; similar lesions are caused in the Bonin Islands by *Eobia cinereipennis ogasawarensis*, Mats., another beetle of the same family.

KUWAYAMA (S.). Report on the Distribution of and the Conditions of Injuries by Insect Pests of Important agricultural Crops in Manchukou. Appendix. Report concerning Blood-sucking Insects in Manchoukou. [In Japanese.]—*Sangyobu Shiryo* no. 33, 112 pp., 11 pls. Shinkyo, Manchuria, Bur. Ind. Govt Manchukou, 1938.

In the appendix (pp. 89–112), notes are given on the chief families of blood-sucking insects that occur in Manchuria. Lists of 19 species of Tabanids and 17 of mosquitos are included, with brief descriptions of some of them and keys to the genera.

PAPERS NOTICED BY TITLE ONLY.

GOIDANICH (A.). Si può combattere la mosca domestica con la calciocianamide? [Is it possible to control *Musca domestica*, L., with Calcium Cyanamide? (including a brief account of the author's negative experiments.)]—*Italia agric.* **75** no. 4 pp. 259–265, 7 figs. Rome, 1938. [Cf. R.A.E., B **26** 224.]

JOYEUX (C.), SAUTET (J.) & ARTAUD (P.). *Sur un cas de myiasis rampante* [probably caused by larvae of *Gastrophilus haemorrhoidalis*, L., in Corsica].—*Bull. Soc. Path. exot.* **31** no. 10 pp. 922-924, 1 fig., 1 ref. Paris, 1938.

BERTRAM (D. S.). *A Note upon Myiasis due to the Larvae of Cordylobia rodhaini Gedoelst* [in man in Br. Cameroons].—*Ann. trop. Med. Parasit.* **32** no. 4 pp. 431-435, 2 figs., 17 refs. Liverpool, 1938.

DAMPF (A.). *Un nuevo Phlebotomus (Insecta, Diptera, Fam. Psychodidae) procedente de Texas, E.U.A.* [*P. texanus*, sp. n., from a nest of *Atta texana*, Buckley, in Texas].—*An. Esc. nac. Cienc. biol.* **1** no. 1 pp. 119-131, 4 pls. Mexico, D.F., 1938.

MANGABEIRA FILHO (O.). *Sobre duas novas espécies de Flebotomus (Diptera : Psychodidae).* [Descriptions of males of *Phlebotomus lenti* and *P. cruzi*, spp. n., and of females of two unidentified species of *Phlebotomus* from Brazil].—*Mem. Inst. Osw. Cruz* **33** fasc. 3 pp. 349-356, 5 pls., 9 refs. Rio de Janeiro, 1938.

DIAS (E.). *Criação de Triatomídeos no laboratorio. (Com um appendice pelo Dr. C. B. Philip e 4 estampas).* [The Maintenance of Triatomids in the Laboratory. With an Appendix by Dr. C. B. Philip ; describing modifications of the method used by Dias].—*Mem. Inst. Osw. Cruz* **33** fasc. 3 pp. 407-412, 4 pls., 7 refs. Rio de Janeiro, 1938.

FINLAY (C. J.). *El mosquito hipotéticamente considerado como agente de transmisión de la fiebre amarilla.* [The Mosquito hypothetically considered as the Vector of Yellow Fever (the text of a paper read at Havana in 1881).]—*Rev. Med. trop. Parasit.* **4** no. 4 pp. 163-184, 1 fig., 1 portr. Havana, 1938.

KOMP (W. H. W.) & KUMM (H. W.). *A new Species of Haemagogus, mesodentatus, from Costa Rica, and a Description of the Larva of Haemagogus anastasionis Dyar (Diptera, Culicidae).*—*Proc. ent. Soc. Wash.* **40** no. 9 pp. 253-259, 6 figs. Washington, D.C., 1938.

BOYD (M. F.) & KITCHEN (S. F.). *An Instance of Protracted Latent Incubation Period [304 days] in a Patient infected with a North American Strain of Plasmodium vivax.*—*Amer. J. trop. Med.* **18** no. 6 pp. 729-731, 1 ref. Baltimore, Md, 1938.

SCHWETZ (J.). *Recherches sur le paludisme endémique du Bas-Congo et du Kwango.*—*Mém. Inst. roy. colon. belge* **7** fasc. 1, 164 pp. 1 fldg map. Brussels, 1938. [Cf. R.A.E., B **26** 185.]

NAINGGOLAN (F. J.). *Over een variëteit van Anopheles gigas uit Oedjali Kalah (Noord Kerintje), en de variabiliteit harer vleugeltekening.* [On an unnamed Variety of *A. gigas*, Giles, from Oedjali Kalah, North Kerintje (West Coast of Sumatra) and the Variability in its Wing Markings].—*Geneesk. Tijdschr. Ned.-Ind.* **79** pt. 3 pp. 163-170, 15 figs., 6 refs. Batavia, 1939. [Cf. R.A.E., B **22** 208, 232; **23** 119.]

MOHLER (J. R.). **Report of the Chief of the Bureau of Animal Industry,**
19[37-]38.—85 pp. Washington, D.C., U.S. Dep. Agric., 1938.

The progress of the campaign for the eradication of *Boophilus annulatus*, Say, on cattle, horses and mules in the United States led to the reduction of the area under Federal Quarantine to 4 per cent. of its original size [cf. R.A.E., B 26 78]. In the campaign in Porto Rico, where *B. a. microplus*, Can. (*australis*, Fuller) is prevalent, it was also necessary to treat sheep and goats. Complete eradication in Florida has been delayed by the presence in some areas of tick-infested deer, but legislation in 4 of the 6 counties in which infested game preserves are situated enabled satisfactory progress to be made in removing the deer; the problem remains in the other two counties.

In the course of investigations on anaplasmosis, it was found that the disease was not transmitted to susceptible cattle by any stage of the progeny of females of *Dermacentor variabilis*, Say, *D. andersoni*, Stiles, or *Rhipicephalus sanguineus*, Latr., that had been placed on infected cattle. The report that developmental stages of the common sheep tapeworm (*Moniezia expansa*) had been recovered from Oribatid mites of the genus *Galumna* that had ingested the eggs led to an investigation in sheep pastures. Several species of mites were found, of which species of *Galumna* were the least abundant. Five infective larvae isolated from five mites were fed at intervals to a lamb, and it was found to contain two tapeworms a month after the first feeding.

Experiments on the control of the larvae of warble-flies [*Hypoderma*] in the backs of cattle were carried out with washes consisting of 4 oz. white flaked soap in 1 U.S. gal. water to which was added either 1 lb. derris powder (5 per cent. rotenone) or 1 oz. rotenone. When applied to the warbles with a bristle brush or with a soft cloth, the derris wash killed 96·7 and 75·8 per cent. of the larvae, respectively, and the rotenone wash killed 83·2 and 61·6 per cent. Investigations carried out over a period of three years indicate that moderate infestations of cows by warble-flies do not influence milk production. In experiments in New Mexico and Texas on the control of grub [*Oestrus ovis*, L.] in the head of sheep, a 3 per cent. Lysol solution [cf. 26 78] was injected by means of compressed air into the nasal passages of 12,215 sheep. The average numbers of larvae per animal were 1·2 in sheep treated while lying on their backs and 0·8 in those treated standing with the nose held tilted upwards in a special head rest, whereas in untreated animals the average was 10·8.

During the summer and autumn of 1937, the most serious losses ever caused by infectious equine encephalomyelitis were recorded in the United States, a survey by questionnaire indicating that more than 169,000 cases and approximately 40,000 deaths occurred. The disease has been specifically diagnosed in 22 states. Several thousand mosquitos and stable flies [*Stomoxys calcitrans*, L.] and a few other Diptera were collected from infected and normal animals or from the vicinity of premises in which cases had occurred, and these, as well as a small batch of ear ticks [*Amblyomma maculatum*, Koch], were fed on or injected into laboratory animals, chiefly guineapigs. About 500 guineapigs were used, but, with a few exceptions involving inconclusive evidence, none developed symptoms of the disease. Two ponies, a mare and a foal were subjected to the bites of approximately 4,000 stable flies, but did not develop symptoms. The disease rapidly disappeared with the onset of severe frosts. Despite the failure to

demonstrate the virus in blood-sucking insects in nature, the known facts concerning the disease strongly support the prevailing opinion, based on experimental evidence, that it is transmitted by them in the field. Mosquitos appear to be the most likely vectors. In an investigation on the possibility of infectious anaemia of horses (swamp fever) being transmitted by parasites, 45 examples of *Haematopinus asini*, L., were transferred from an infected horse during an acute febrile reaction to a healthy horse, but the latter did not become infected.

Parasitological Investigations.—*Bienn. Rep. Kans. agric. Exp. Sta.* **9** (1936-38) pp. 116-117. Manhattan, Kans., 1938.

Experiments in Kansas have shown that 12 species of Carabids, belonging to the genera *Pterostichus*, *Amara*, *Anisotarsus*, *Chlaenius*, *Anisodactylus* and *Harpalus*, can act as intermediate hosts of the fowl tapeworm, *Raillietina cesticillus*; as many as 626 cysticercoids were produced in one beetle that had ingested four proglottids. In an experiment in which 20 fowls were exposed to house-flies [*Musca domestica*, L.] that had access to proglottids and eggs of *Choanotaenia infundibulum*, and beetles were excluded, 15 of the fowls became infested with this tapeworm. Dissection of the flies revealed cysticercoids in their body cavities. It is concluded that house-flies are important intermediate hosts of *C. infundibulum* and might possibly also serve as intermediate hosts of *R. cesticillus*.

A filter-passing Infectious Agent isolated from Ticks.

DAVIS (G. E.) & COX (H. R.). **I. Isolation from *Dermacentor andersoni*, Reactions in Animals, and Filtration Experiments.**—*Publ. Hlth Rep.* **53** no. 52 pp. 2259-2267, 1 ref. Washington, D.C., 1938.

PARKER (R. R.) & DAVIS (G. E.). **II. Transmission by *Dermacentor andersoni*.**—*T.c.* pp. 2267-2270, 2 refs.

COX (H. R.). **III. Description of Organism and Cultivation Experiments.**—*T.c.* pp. 2270-2276, 7 refs.

DYER (R. E.). **IV. Human Infection.**—*T.c.* pp. 2277-2282, 5 refs.

In the third of these papers on a filter-passing agent, infectious to laboratory animals, that was isolated from the tick, *Dermacentor andersoni*, Stiles, in Montana, an account is given of experiments which showed that the virus was able to survive in and be transmitted by nymphs and adults of *D. andersoni* that had ingested it in the larval stage and by the progeny of infected females. In the fourth paper, a description is given of a case of accidental infection in man in which the causal organism was found by cross-immunity tests to be identical with that isolated from the tick.

SHARIF (M.). **Diseases transmitted by the Indian Species of Ticks and the Possibility of their Prevention through Biological Control.**—*Indian J. vet. Sci.* **8** pt. 4 pp. 353-366, 61 refs. Delhi, 1938.

The author reviews the literature on the relation of ticks that occur in India to diseases of domestic animals in India and other parts of the world and on their natural enemies. In appendices, he gives lists of ticks that occur in India on domestic animals, showing their distribution and usual hosts, and the diseases they transmit in India or elsewhere.

SONI (B. N.). Observations on the Bionomics of the Ox Warble-fly (*Hypoderma lineatum* de Villers).—*Indian J. vet. Sci.* 8 pt. 4 pp. 375–380, 3 figs., 6 refs. Delhi, 1938.

The observations on *Hypoderma* described in this paper were made chiefly at Mukteswar in the Kumaun Hills (altitude 7,500 ft.) in 1937. A systematic survey of hill bulls undertaken in January showed that about 53 per cent. were infested, and about 50 mature larvae taken from the warbles were all identified as *H. lineatum*, Vill. This is the only species so far recorded from this locality, where it appears to be indigenous, since warbles were observed during the winter in dairy cows born and bred at Mukteswar and oesophageal forms of the larvae were recovered during July 1937 from bulls kept there since October 1936. *H. lineatum* is also abundant in the Punjab, a fact indicating that its incidence is not influenced to any appreciable extent by temperature and topography, although differences in temperature conditions may explain why warbles continued to appear in the backs of cattle at Mukteswar until early March, whereas it is reported that they have not been observed at Hissar, Punjab, after the middle of January. During a short tour in the Punjab in the winter of 1937, the author observed that the pest was most prevalent in areas with a sandy loam soil where rainfall was scanty. The districts of Hissar and Fezropore were found to be comparatively heavily infested. Oesophageal forms of the larvae of *H. lineatum* were observed at Mukteswar from March 1937 until the time of writing (October 1937), a finding that is difficult to reconcile with the generally accepted view that the fly has only one generation a year in India. In 18 warbles, the average interval between the first appearance of the warble and the emergence of the larva was 51 days. Weekly weighings of five heavily infested and two uninfested bulls over a period of nearly 3 months (February to April) showed that the weight of the infested animals decreased until the middle of March (about the time when most of the larvae escape from the warbles) after which it gradually increased, whereas there was no appreciable loss of weight in the control animals.

ABDUSSALAM (M.). The Occurrence of Equine Nasal Bot, *Rhinoestrus purpureus* (Brauer, 1858) in India.—*Vet. J.* 95 no. 1 pp. 36–38, 11 refs. London, 1939.

Five larvae of *Rhinoestrus purpureus*, Brauer, were found in the nasal sinuses of a donkey at Lahore in March 1938. This appears to be the first time that the fly has been recorded in India or from this host. It must be capable of breeding in India since the donkey was born locally, but it is not known whether it has recently been imported or has long been established. A description of the third-stage larva is quoted to facilitate its identification by workers in India.

NAIK (R. N.). Existence of Otocariasis (Ear Mange) in Goats in India.—*Vet. J.* 95 no. 1 pp. 43–45, 1 pl., 3 refs. London, 1939.

An account is given of an outbreak of disease in a herd of goats in the Poona District of Bombay in 1936, which was found to be due to infestation of the ears by *Psoroptes caprae*, Railliet. The symptoms are described. A mixture of 1 part creosote, 1 part methylated spirit and 10 parts oil was applied with a brush to the meatus of the ears of affected goats, and the same mixture, further diluted with an equal quantity of oil, was applied as a preventive to the healthy

animals. Microscopic examination of scabby material collected 24 hours after treatment showed 5 per cent. of the mites to be alive, but after three treatments at weekly intervals no mites were observed. The outbreak subsided within three weeks and did not reappear in the two following years, during which periodic examinations were made.

SERVER KAMIL & SAIT BILAL. **Recherches expérimentales sur l'étiologie de la tularémie en Turquie.**—*Ann. Parasit. hum. comp.* **16** no. 6 pp. 530–542, 1 fig., 8 refs. Paris, 1938.

Observations in Eastern Thrace in 1936 and 1937 revealed a number of cases of tularemia in man, some of several years standing; in August 1937 the disease was diagnosed at Konya, in the centre of Asia Minor, in a person who had never left the region and had had no connections with Thrace. Researches at Ankara indicated that the disease is more widely distributed in Turkey than was previously believed.

The account given in this paper of laboratory investigations on tularemia carried out at Ankara includes a section on possible vectors. It is stated that although cases in man in Europe are usually contracted by direct contact with an infected animal and no vector has yet been found [but cf. *R.A.E.*, B **27** 138], it is more than probable that Arthropods play an important part in the transmission of the disease among animals. Experiments were carried out with *Cimex lectularius*, L., *Ctenocephalides (Ctenocephalus) canis*, Curt., and *Ornithodoros lahorensis*, Neum. Bed-bugs fed on an infected guineapig were transferred to 28 healthy guineapigs, of which one became infected. The bugs had been fed on this animal 24 hours after the infecting feed and daily for 16 days thereafter. The disease was also transmitted to guineapigs by crushing infected bugs on the shaved skin, by injecting the faeces of infected bugs, and by injecting a suspension of larvae derived from infected bugs, although in the last case transmission may have been due to the contamination of the larvae with infected faeces from the adults. A suspension of 26 examples of *Ctenocephalides canis* from a cat that had died of tularemia was inoculated subcutaneously into a guineapig, which did not, however, become infected. Examples of *O. lahorensis* that had previously fed on infected animals were allowed to feed several times on two healthy guineapigs, both of which contracted the disease. Guineapigs were also infected by inoculation of suspensions of these ticks, even when the suspension was made of ticks that had died 10 days previously and had had their infecting feed four months before.

BRAUN (H.) & CASPARI (E.). **Sur la propagation de maladies d'origine bactérienne par des *Culex* et des punaises.**—*Ann. Parasit. hum. comp.* **16** no. 6 pp. 543–547, 12 refs. Paris, 1938.

Since a study of the literature showed that the part played by mosquitos of the genus *Culex* and by bed-bugs [*Cimex*] in the transmission of bacterial diseases is not altogether clear, experiments were undertaken to elucidate the problem. Females of *Culex pipiens*, L., after feeding on mice and canaries infected with paratyphus, were dissected at intervals and examined. The bacilli were conserved in the body of these mosquitos for 3–4 weeks, but they were seldom retained in the proboscis, and were not observed in the heads of mosquitos that had fed 1–6 days previously. They were found in the

faeces from about 3 to 20 days after the infecting feed, although in many cases they were absent after 7 days. The numbers of bacilli excreted in the faeces may be considerable, and it is estimated that at least 100,000 were contained in the faeces deposited in one night by a mosquito that had fed on an infected animal two days previously. The water on which mosquitos infected 4-6 days previously laid their eggs, and the foodstuffs on which they fed, became contaminated with bacilli.

In experiments in which bed-bugs were fed on infected mice, similar results were obtained. Paratyphus bacilli were found in the bodies and faeces of bugs up to 3 weeks after the infecting feed, the faeces containing them from the 4th day onwards. Eggs laid 4-14 days after the infecting feed were free from bacilli, but larvae may become contaminated in the places where the bugs hide. No bacilli were found in the piercing organs of the bugs up to the 19th day after feeding, although large numbers were found in the rostrum.

Oswald (B.). Revue des travaux publiés en Yougoslavie sur le problème des tiques et nouvelles recherches sur le poison de leurs œufs.—*Ann. Parasit. hum. comp.* **16** no. 6 pp. 548-559, 1 pl., 35 refs. Paris, 1938.

A list is given of the ticks found in southern Serbia [cf. *R.A.E.*, B **26** 91], and previous work on the poison contained in the eggs of certain species is reviewed [cf. **24** 246; **25** 250]. The work was continued with *Rhipicephalus bursa*, C. & F., and *R. sanguineus*, Latr., and extracts were made of the eggs of these species according to the method previously used [cf. **24** 246], which is again described. Nine out of 12 guineapigs inoculated with extract from the eggs of the first species and 2 out of 6 of those inoculated with extract from eggs of the second species died, and the symptoms were similar to those shown by guineapigs in the previous experiments. The guineapigs that survived showed no symptoms. The name ixovotoxin is suggested for the poison, the properties of which are discussed. The duration of the experimental paralysis appeared to be in inverse relation to the amount of extract injected, which proves that the poison always acts in the same way, and the loss in body weight of the animal seemed to be proportional to the duration of the disease.

Regendanz & Reichenow [**19** 180] considered that the poison in the eggs of ticks is identical with that secreted by their salivary glands. Thus, a species could be recognised as one that produces paralysis if its eggs contained poison. The author's investigations have, however, shown that in southern Serbia there are at least four species of ticks of which the eggs contain poison, and that at least one of these is present in large numbers on domestic animals during each season of the year. It is, therefore, difficult to explain the rarity of clinical cases of tick paralysis and the fact that epidemics seem to occur at regular intervals.

Remlinger (P.) & Bailly (J.). Contribution à l'étude expérimentale des accidents déterminés par la tique du chien (*Rhipicephalus sanguineus*).—*Ann. Parasit. hum. comp.* **17** no. 1 pp. 1-3, 1 ref. Paris, 1939.

Various species of ticks are known to cause paralysis in man, but among workers who have attempted to reproduce it in laboratory

animals some have obtained positive and some negative results, while the former are not in agreement as to whether the infecting agent occurs in the eggs or in blood taken from the ticks. The authors describe experiments with *Rhipicephalus sanguineus*, Latr., in which rabbits and guineapigs were inoculated with blood taken from the digestive diverticula of the ticks by puncture with a pipette, with the contents of the abdomen of crushed ticks, and with their eggs. Among the 130 animals inoculated, one definite case of paralysis occurred in a rabbit inoculated with blood from the ticks, and 2 rabbits and 7 guineapigs died, after showing symptoms of paresis rather than paralysis 5-72 days after inoculation. The authors conclude, however, that all these results should be considered negative, particularly as both the incubation periods and the symptoms were very variable.

DEL PY (L.) & RAFYI (A.). *Sur la fièvre récurrente sporadique en Iran. Contribution à l'étude expérimentale de Spirochaeta persica Dschunkowsky, 1913.* —*Ann. Parasit. hum. comp.* 17 no. 1 pp. 45-61, 3 figs., 4 charts, 5 refs. Paris, 1939.

Relapsing fever in Iran was believed to be confined to foreign travellers until investigations in 1937 revealed it in several persons living at Hessarek (about 38 miles to the east of Teheran), all of whom had been exposed to the bites of *Ornithodoros tholozani*, Lab. & Mégn. (*papillipes*, Bir.). In the course of a study, described in this paper, of the strain of *Spirochaeta persica* concerned, a certain number of experiments on its transmission were undertaken with adults of both sexes and nymphs of *O. tholozani* and *O. lahorensis*, Neum., that had fed on infected laboratory animals or had been collected in dwellings where cases of infection had occurred, and a single experiment with nymphs of *Hyalomma dromedarii*, Koch, fed as larvae on an infected rabbit. The only positive results were obtained with *O. tholozani*. A nymph, infected after its first moult, transmitted the disease after 116 days and again after 458 days, when it had reached the adult stage. Another infected nymph transmitted the disease to a rat after 345 days, although it had failed to infect a rabbit after 100 days. A female that infected a rat 371 days after feeding on an infected rabbit had laid eggs 328 days after this feed, and the larvae that hatched from them transmitted the infection to two rats. Further experiments are being carried out; at present it appears that *O. tholozani* is the usual vector of the spirochaete.

UROUKOFF (B.). *Sur la dermatite causée par le Pediculoides ventricosus.* —*Ann. Parasit. hum. comp.* 17 no. 1 pp. 69-71, 1 fig. Paris, 1939.

Preliminary investigations in 1933 showed that outbreaks of dermatitis that occur in south-eastern Bulgaria are due to *Pediculoides ventricosus*, Newp. [cf. R.A.E., B 25 153]. In 1937, an outbreak occurred at Haskovo and, particularly, in localities near the Greek frontier. Further work revealed the wide distribution of the mite in certain regions of southern Bulgaria, where it is found at altitudes of up to about 2,000 ft. There is usually an epidemic spread of the disease 10-15 days after reaping, at the time when the crops (wheat and barley) are being handled, but cases may also occur later in the season and even at the beginning of the following summer. In the

infested regions under ordinary conditions of storage (in granaries, sacks, large heaps, etc.), the mite develops throughout the year, though it increases considerably during the warm months after reaping, when abundant nourishment (insect larvae and pupae [*cf.* 26 65]) is available. The measures suggested for controlling the disease include avoiding contact with infested grain or straw, or with the "dust" from cereals during harvesting operations; grinding the grain immediately after reaping; burning infested straw; prohibiting the transport of infested or suspected cereals (all cereals harbouring insect larvae or pupae should be considered suspect); and fumigating all granaries, warehouses, and cargo boats in which infested or suspected cereals have been deposited with sulphur, hydrocyanic acid gas or carbon tetrachloride.

CALLOT (J.). *Sur quelques gîtes et associations larvaires de moustiques*.—*Ann. Parasit. hum. comp.* 17 no. 1 pp. 86-87. Paris, 1939.

Larvae of *Aëdes geniculatus*, Ol., which usually occur in holes in trees, particularly those in beech, were found at Souzy (Seine-et-Oise) in large numbers and on several occasions in pools in rocks in a thick wood of beeches and oaks. The water was contaminated with decomposing leaves and resembled in colour and appearance that found in tree-holes. Records are given of other species of mosquitos with which *A. geniculatus* is associated in both types of breeding places in France.

Larvae of *A. mariae*, Ed. & Et. Serg., were found in Corsica in cracks in rocks in which the water contained decomposing algae, as well as in holes containing clean salt water. This species is known to be variable [*cf.* R.A.E., B 26 121], and the author describes the larvae and male adults obtained in Corsica, since they appear to differ slightly from the other forms described.

IVES (J. D.). *Cave Hibernation of Mosquitoes*.—*J. Tenn. Acad. Sci.* 13 no. 1 pp. 15-20, 1 fig. Nashville, Tenn., 1938.

Observations in Tennessee, mostly in the winters of 1934-35 and 1935-36, showed that the commonest mosquito hibernating in caves was *Anopheles punctipennis*, Say, though *A. quadrimaculatus*, Say, was also taken in small numbers in the south-eastern part of the state. The other species overwintering in caves belonged to the genus *Culex*. Most individuals were taken in the twilight zone in the caves, none having penetrated into darker parts. In a discussion of these results, it is suggested that mosquitos enter caves in search of darkness on days when the temperature and humidity in them are the same as those in the open, and that they are prevented subsequently from leaving by unfavourable conditions outside.

FINDLAY (G. M.) & MACCALLUM (F. O.). *Epidemiology of Yellow Fever*.—*Nature* 143 no. 3616 p. 289. London, 1939.

It has proved possible to infect monkeys with yellow fever by introducing the virus into their stomachs, and the virus has been found to retain its activity for at least 15 days when injected into the abdomen of the cockroach, *Blatella germanica*, L. It has long been known that both African and South American monkeys supplement their mainly vegetarian diet with insects, and, in view of the above observations, the authors suggest that it would be of interest to

determine what animal foods are eaten under natural conditions by monkeys in yellow-fever areas in Africa and South America, since non-biting Arthropods might be shown to act in this way as vectors of the disease.

RUSSELL (P. F.). **Malaria due to Defective and Untidy Irrigation. A preliminary Discussion.**—*J. Malar. Inst. India* 1 no. 4 pp. 339-349, 11 pls., 22 refs. Calcutta, 1938.

The author points out that although a relation between irrigation and malaria was recognised before 1850, the question of malaria prevention is scarcely mentioned in modern text-books on agricultural engineering, and although immense sums have been spent on irrigation schemes, practically no malaria research had been undertaken in connection with them. It would appear that it is not irrigation in itself that promotes Anopheline breeding, but defects in the construction, maintenance and operation of the irrigation systems. An intensive study of the means by which such defects can be corrected in existing systems and avoided in future schemes is being undertaken at a field station in Pattukkottai taluk, Madras, where the installation of an irrigation system in 1933-34 was promptly followed by the appearance of malaria [cf. *R.A.E.*, B 27 44]. In this preliminary paper, a list is given of the ways in which irrigation systems may cause the formation or persistence of Anopheline breeding places and so increase the incidence of malaria. These include, in addition to those already noticed [*loc. cit.*] : using defective or misplaced distributing chambers, which send water where it is not required or block the flow of water ; improperly delivering the water, so that it flows along roadways, roadside ditches, etc. ; providing an insufficient number of bridges, so that canals are crossed without them and foot-paths and cart tracks breach the banks ; cutting off and leaving sections of old canals that happen to be in the line of new ones ; and permitting the presence of unplanned streams and channels by means of which irrigation water finds its way into reservoirs and rivers. Specific means for correcting or preventing such defects will be dealt with in subsequent papers, but the need for organisation and co-operation in all work dealing with irrigation malaria is emphasised.

CHOPRA (R. N.) & BASU (B. C.). **Studies on the Effect of Anti-malarial Drugs upon the Infectivity of Patients to Mosquitoes. Part II. "Cilional."**—*J. Malar. Inst. India* 1 no. 4 pp. 351-352, 1 ref. Calcutta, 1938.

In continuation of previous work [cf. *R.A.E.*, B 26 57], 414 females of *Anopheles stephensi*, List., were fed on three carriers of gametocytes of *Plasmodium falciparum* before and after treatment with "cational" and atebrin combined in different proportions and administered 3 times a day. Crescents were present and infective to mosquitos even after 4 days' treatment with the highest dose (0.02 gm. cilional plus 0.1 gm. atebrin). Moreover, salivary gland infections were observed in mosquitos fed on patients after treatment for 3 days. In a postscript, it is stated that when the dose was increased to 0.03 gm. cilional, crescents did not disappear after 4 days' treatment, but they were not infective to mosquitos, as judged by dissection of the females surviving from 235 fed on two cases before and after treatment.

ROY (D. N.). On the Control of Malaria-Mosquitoes in Bengal by the Use of Predaceous Fish and on the Habits of two of them.—*J. Malar. Inst. India* 1 no. 4 pp. 405–416, 11 refs. Calcutta, 1938.

The use of fish for the control of mosquito larvae is discussed, and an account is given of field and laboratory observations on the behaviour of *Panchax panchax* and *Barbus phutunio*. The two most important vectors of malaria in Bengal are *Anopheles philippinensis*, Lidl., and *A. varuna*, Iyen., which breed, respectively, in neglected reservoirs and in weedy and partly shaded reservoirs. The presence of duck-weeds (*Lemna* and *Azolla*) alone was sufficient to interfere with the action of fish on Anopheline larvae, so that unless it is possible to remove vegetation or prevent its growth, their utilisation in the control of malaria will be impracticable. It is concluded that, although fish may aid in checking the multiplication of mosquitos in general, the practical benefits likely to be derived from their extensive use for the control of malaria in rural areas in Bengal would be too slight to make it a measure of economic value.

ROY (D. N.), CHANDRA (S. N.) & SIDDONS (L. B.). On the Presence of a Zoophilic Race of *A. stephensi* in Calcutta.—*J. Malar. Inst. India* 1 no. 4 pp. 417–426, 22 refs. Calcutta, 1938.

The absence of endemic malaria in Calcutta despite the abundance of *Anopheles stephensi*, List., the probable presence of a sufficient number of gametocyte carriers, and climatic conditions that would appear to be favourable for transmission there during late autumn and winter, are discussed, and the difficulty experienced by many workers in collecting adults of this species is pointed out. Of 172 females caught in a bedroom in a house in the vicinity of cowsheds and subjected to the precipitin test, 111 had fed on cattle and only 4 on man (the blood in the remaining 57 had disintegrated). The authors conclude that the species is zoophilous in Calcutta, and that this accounts for there being only a few indigenous cases of malaria in the city. The question of whether distinct races of *A. stephensi* [cf. R.A.E., B 26 49] are implicated is also discussed.

AFRIDI (M. K.) & MAJID (S. A.). Malaria in Bahrein Islands (Persian Gulf).—*J. Malar. Inst. India* 1 no. 4 pp. 427–472, 3 maps, 1 chart, 14 refs. Calcutta, 1938.

An account is given of investigations carried out in 1938 on malaria and its transmission on the islands of Bahrein and Muharrak in the Persian Gulf. It was found to be prevalent throughout these islands, and its severity in most places in Bahrein was related to their proximity to the belt of date palm groves along the coast. In the plantations, the amount of mosquito breeding varied with the type of irrigation used. Gardens irrigated from springs were almost completely waterlogged and those irrigated from artesian wells partly so, and mosquito breeding, which was most abundant in these types, was caused chiefly by excessive irrigation and inadequate drainage; in gardens in which the irrigation water was lifted mechanically, the supply was intermittent and limited, and breeding was restricted to wells and pits holding subsoil water. Domestic breeding places were practically confined to shallow wells and water in private gardens. The species of Anophelines found were *Anopheles stephensi*, List., *A. pulcherrimus*, Theo., *A. fluviatilis*, James, and *A. sergenti*, Theo. *A. stephensi* predominated both in the

adult and larval stages, and, as it was the only species found infected in nature, it is concluded that it is chiefly responsible for the transmission of malaria in these islands. Observations on its breeding places indicate that its presence or absence is related to the degree of salinity of the water; the upper limit of salinity of water from which larvae were taken was 2,750 parts chlorine per 100,000. Observations on the behaviour of the adults indicate that they select day-time resting places in houses in the vicinity of breeding places, but make daily incursions into the interior of the town in search of food. The occurrence of malaria in a village that was about $1\frac{1}{2}$ miles from the nearest breeding place indicates that *A. stephensi* has a flight-range of at least this distance. Recommendations regarding both temporary and permanent measures for the control of malaria in Bahrein are given in detail. Vertical drainage to a permeable stratum is suggested as the method of choice for the relief of water-logging, and the use of Paris green and of the local larvivorous fish, *Aphanius (Lebias) dispar*, is recommended for the control of larvae.

CHEDECAL (M.). *Contribution à l'étude du comportement trophique des anophélines à Hanoi* (Enclos du 9e R.I.C.).—*Rev. méd. franç. Extr.-Orient* 1938 no. 8 pp. 1007-1011, 4 refs. Hanoi, 1938.

Although investigations on the food-preferences of Anophelines have been undertaken in Tonkin [cf. *R.A.E.*, B 24 81], none has been carried out in the town of Hanoi. To determine the behaviour of Anophelines in a locality where large numbers of men and animals live in close association, a study was made in a cavalry barracks where 160 horses were stabled. Collections were made during the day and at night in both the wet and dry seasons. Few Anophelines were found in dwellings, but large numbers were taken in stables. The most numerous species and the only ones that contained human blood were *Anopheles hyrcanus* var. *sinensis*, Wied., and *A. vagus*, Dönn.

Precipitin tests showed that of 107 females of the former, 102 had fed on horses only, 1 on man only, and 2 on both, while of 111 of the latter, 107 had fed on horses and 3 on man. Captures made in barracks, even in those far from the stables, were nearly always of females engorged with animal blood. The horses obviously attracted these zoophilous species in spite of the poor conditions of stabling.

SOLLIER (R.). *Sur un cas remarquable de myiasis du conduit auditif par Chrysomyia bezziana*.—*Rev. méd. franç. Extr.-Orient* 1938 no. 8 pp. 1016-1018, 3 refs. Hanoi, 1938.

The author draws attention to a number of cases in Tonkin in which the ear passages of natives suffering from otorrhoea contained living or dead flies or living maggots, and describes a case in which 89 larvae of *Chrysomyia bezziana*, Villen., were removed over a period of four successive days from the right ear and the inner corner of the right eye of a four-year-old child.

KUWAYAMA (S.) & KATO (S.). *On Lyperosia irritans L., the so-called Horn-fly, in Japan.* [*In Japanese.*]—*Oyo Kontyū* 1 no. 4 pp. 151-159, 1 pl. Tokyo, 1939.

Lyperosia irritans, L., is widespread in Hokkaido, where it was first observed in 1937. It is common on cows, but very rare on horses.

Near Sapporo, adults were observed from June or earlier; they suddenly increased in numbers in August, and disappeared in mid-October. The morphology of the adult is described and compared with that of *Stomoxys calcitrans*, L.

LEVER (R. J. A. W.). **Entomological Notes. 3. A Javanese Beetle to Control Houseflies.**—*Agric. J. Fiji* 9 no. 4 pp. 15, 18. Suva, 1938.

In November 1938, the predatory beetle, *Hister chinensis*, Quensel, was introduced into Fiji from Java for the control of house-flies [*Musca domestica vicina*, Macq.] and 1,400 examples were released in Suva. Before liberation, some of the beetles were placed in a petri dish with house-fly and blowfly maggots, which they attacked voraciously. It is hoped that they will devour such maggots in cow-dung in nature, especially since they have a powerful flight and spend most of their time tunnelling in the dung in pursuit of their prey and so will be protected from the attacks of the giant toad [*Bufo marinus*].

GOPSILL (W. L.). **Onchocerciasis in Nyasaland.**—*Trans. R. Soc. trop. Med. Hyg.* 32 no. 4 pp. 551-552. London, 1939.

Although it is generally recognised that onchocercosis (due to *Onchocerca volvulus*) has been prevalent in Nyasaland for many years, the author has failed to trace any mention of this fact in medical literature, and he therefore gives notes on cases with which he has come into contact. Of these, 20 were living in an area in the Shire Highlands where fast-flowing mountain streams occur and the vector, *Simulium damnosum*, Theo., is found.

GERTLER (S. I.) & HALLER (H. L.). **The Pyrethrin Content of Home-made Fly Sprays.**—*Soap* 15 no. 1 pp. 93-94, 4 refs. New York, N.Y., 1939.

During recent years, instructions have been issued for preparing at home pyrethrum extracts for use against flies in the house and on the farm, but the economy of this practice has been questioned, chiefly because it is believed that the procedures recommended do not completely remove the active principles from the pyrethrum powders. The experiments described were undertaken to throw light on this question. Kerosene extracts from seven samples of pyrethrum powder of different ages obtained from different sources were made according to a typical set of directions and their pyrethrin contents compared with those obtained by exhaustive extraction of the same samples. About 94 per cent. of the total pyrethrins was removed by the kerosene extraction. When the proportion was 1 lb. powder to 1 U.S. gal. kerosene, 73 per cent. of the total solution was recovered by decantation after 48 hours' maceration, but when it was 2 lb. to 1 U.S. gal., only 57 per cent. of the solution was recovered. A good commercial pyrethrum spray is one containing at least 100 mg. total pyrethrins per 100 cc. of solution, and it was estimated that this is obtained from samples containing about 0.9 per cent. total pyrethrins used at the rate of 1 lb. to 1 U.S. gal. kerosene. Thus, to obtain 1 U.S. gal. of kerosene extract of pyrethrum containing 100 mg. pyrethrins per 100 cc., it is necessary to use about 1½ lb. pyrethrum powder of 0.9 per cent. total pyrethrins and 1½ U.S. gals. kerosene. Since 6 of the 7 samples of pyrethrum tested contained less than this amount of total

pyrethrins, it is necessary in most cases to use still larger amounts of pyrethrum and kerosene. In the case of a powder of only 0·45 per cent. total pyrethrins (one of the samples contained only 0·40 per cent.), it would be necessary not merely to double the quantity of pyrethrum powder, but to use 3½ lb. in 1½ U.S. gals. kerosene to compensate for the much lower amount of solution (57 per cent.) that can be decanted.

STRONG (L. A.). Report of the Chief of the Bureau of Entomology and Plant Quarantine, 19[37-]38.—84 pp. Washington, D.C., U.S. Dep. Agric., 1938.

Part of this report (pp. 60-62) deals with work carried out in 1937-38 on insects affecting man and animals in the United States.

In certain sections of the south-western United States, several species of ants, especially those belonging to the genera *Eciton* and *Pheidole*, destroy 65-90 per cent. of the larvae and pupae of *Cochliomyia hominivorax*, Coq. (*americana*, Cush. & Patt.) that develop from the carcasses of animals that have died of screwworm infestation. Histerid beetles are not known to prey on larvae of *C. hominivorax*, but they devour large numbers of larvae of other species of blowflies present in carcasses. Temperature considerably affects the populations of various genera of blowflies. During periods when the mean monthly temperature range is below 50°F., between 50 and 70°, and above 70°, the predominant genera are *Calliphora* and *Cynomyia*, *Phormia*, and *Cochliomyia*, respectively.

Investigations have shown that there is a close relationship between temperature and the percentage of larvae that hatch from the eggs of certain species of flood-water mosquitos in the Pacific North-west. In mid-winter, five alternate dryings and floodings of eggs in the soil are required before they all hatch, whereas in April, May or June, after the eggs have passed the winter in a dormant state, a single flooding will cause all of them to hatch. Eggs that would normally hatch on the first flooding during the period from June to August become dormant again in September, and more than one flooding is then required to make them all hatch. Eggs may change from the dormant state as early as 20th April in early seasons and as late as 8th June in late seasons, so that floods occurring before these dates do not cause the hatching of all viable eggs. Eggs of two of the species concerned, *Aëdes vexans*, Mg., and *A. lateralis*, Mg. (*aldrichi*, D. & K.), have been found to remain viable in the soil for at least four years under natural conditions. Work on methods for controlling mosquito larvae has shown that the addition of 10 per cent. pine oil to a pyrethrum-base oil mixture considerably increases its effectiveness. Cashew-nut shell oil [*cf. R.A.E.*, B 26 234], applied at the rate of 12½ U.S. gals. per acre of water surface, kills 85-95 per cent. of the larvae.

During the year under review, 9,548 examples of *Canthon laevis*, Dru., were shipped to Porto Rico from the United States for the control of the hornfly [*Lyperosia irritans*, L.].

HARTNACK (H.). 202 Common Household Pests of North America.—La. Cr. 8vo, 320 pp. illus. Chicago, Ill., Hartnack Pub. Co., 1939. Price \$3.75 plus postage.

In this eminently readable book, which is planned and illustrated in an original manner, the author has collected information on household pests in the United States, at present scattered throughout

the literature, for the use of those who desire to know more about them than is contained in government and state leaflets. The main part (pp. 45-271), which deals with the bionomics and control of Arthropod pests, is preceded by notes on general classification and on mammal and bird pests, and is followed by sections on pests that feed on keratin (of which hair, wool and feathers are largely composed) and those that infest garbage chutes and incinerators. The remainder of the book contains discussions on miscellaneous subjects, including the dangers of inadequate dissemination of information on the risks associated with the use of fumigants and insecticides poisonous to man, the responsibility of federal and state governments in this respect (particularly when fatalities may occur), with suggestions for minimising such risks, and the desirability of employing original illustrations in entomological publications and of acknowledging the sources of illustrations that are not original.

PHILIP (C. B.) & DIAS (E.). Rocky Mountain Spotted Fever. Failure of Triatomid Bugs to transmit the Virus experimentally. [In Portuguese and English.]—*Mem. Inst. Osw. Cruz* **33 fasc. 4 pp. 469-476, 1 ref. Rio de Janeiro, 1938.**

As Triatomid bugs occur in areas where the closely related and possibly identical diseases, Rocky Mountain spotted fever and Brazilian exanthematic typhus are respectively endemic, the possibility that they may serve as vectors of these diseases is of interest. The only experiments in this connection are those of Dias & Martins, who found that a Minas Geraes strain of Brazilian exanthematic typhus did not persist in *Panstrongylus megistus*, Burm., for two days [*R.A.E.*, B **27** 35]. The experiments described in this paper were carried out with strains of Rocky Mountain spotted fever from Montana, and the bugs used comprised single examples of *Eutriatoma uhleri*, Neiva, and *Triatoma protracta*, Uhler, collected from nests of rodents in the United States, and examples of *T. infestans*, Klug, *Rhodnius prolixus*, Stål, and *P. megistus* from a laboratory stock. *P. megistus*, however, was not used in experiments on transmission by feeding. *E. uhleri*, *T. protracta* and *T. infestans* were fed on susceptible guineapigs 33-141 days, 15 and 37 days, and 8 days, respectively, after feeding on infected ones, and *T. protracta* and *R. prolixus* were given interrupted feeds on infected guineapigs and then fed immediately on susceptible ones, but in no case was the disease transmitted. Faecal droplets were collected from one example of *R. prolixus* two days after its infecting feed and injected into a susceptible guineapig, but did not infect it, although virus was shown to be present in the bug by subsequent injection of the viscera into another guineapig. Tests of the survival of the virus in *T. infestans*, *R. prolixus* and *P. megistus* were made by injecting their gut contents into guineapigs 24-192 hours after the infecting feeds. The longest period for which survival was demonstrated was 72 hours.

DA CUNHA (A. M.). Infecções experimentaes na Leishmaniose visceral americana. Experimental Infections in American Visceral Leishmaniasis.—*Mem. Inst. Osw. Cruz* **33 fasc. 4 pp. 581-598, 9 pls. Rio de Janeiro, 1938. (With an abstract in English.)**

The results are given of experiments with American visceral leishmaniasis [*cf. R.A.E.*, B **25** 15; **26** 89; **27** 66] in which cultures

(and in a few instances crushed spleen and liver) from human and canine cases in Brazil were injected into dogs, a monkey, hamsters (*Cricetus cricetus*), mice, *Dasyprocta agouti* and *Proechimys oris*. Infection was demonstrated in dogs, the monkey and hamsters. The manner of infection was identical with that occurring in other forms of kala-azar, and the lesions produced approximated closely to those in the Mediterranean form of the disease, caused by *Leishmania infantum*. The dermal infections and lesions produced in dogs were similar to those described from naturally infected animals, and are of importance in the transmission of the disease, since the skin harbours the parasites that are taken up by *Phlebotomus* in the act of feeding. The parasites were observed in the skin in all parts of the body, but generally they were more numerous and appeared first on certain sites, such as the paws. It is concluded that the causal agent of American visceral leishmaniasis [which has been described as *L. chagasi* (26 89)] is *L. infantum*.

JACKSON (R. B.). **Notes on *Ae. (F.) togoi* Yamada as met with in the Colony of Hongkong.**—*Chin. med. J.* **54** no. 6 pp. 559–562, 2 figs., 11 refs. Peking, 1938.

In the course of these miscellaneous notes on *Aedes togoi*, Theo., in Hong Kong, the author gives a description of the fourth-instar larva. The larvae have been found in waters of salinities ranging from 0·046 to 1·85 per cent. chlorine (as chlorides), the highest percentage being approximately that contained in sea water. The females constitute a notorious mosquito nuisance; they are found in houses and have been taken during the day-time resting on walls. They have also been taken in the morning in cattle byres, and the midguts of six examples examined contained cattle blood. They have been experimentally infected with *Filaria (Wuchereria) bancrofti* [R.A.E., B **25** 98].

BATES (M.). **Hybridization experiments with *Anopheles maculipennis*.**—*Amer. J. Hyg. (C)* **29** no. 1 pp. 1–6, 12 refs. Lancaster, Pa., 1939.

An account is given of experiments undertaken to confirm the results of those carried out by de Buck, Schoute & Swellengrebel [R.A.E., B **22** 198] on the cross-breeding of the races of *Anopheles maculipennis*, Mg. The technique used is described. The males used for all crosses, including those with hybrid females of the F_2 and F_3 generations, belonged to a German strain of race *atroparvus*, van Thiel. Italian strains of *melanoon*, Hackett, and *labranchiae*, Flni., and Albanian strains of the other races provided the females.

The following is substantially the author's summary: In crosses with females of race *messeae*, Flni., larvae of the F_1 generation failed to hatch or died in the first instar. With females of race *sacharovi*, Favr, the F_1 generation consisted entirely of males with atrophied gonads. With females of race *maculipennis*, adults of the F_1 generation were healthy and vigorous, but both sexes were sterile. With females of race *subalpinus*, Hackett & Lewis, adults of the F_1 generation were healthy and vigorous, but although the females appeared to be normal (many ovipositions were obtained from every experiment, but no dissections were made), the males were sterile; in the F_2 generation, females were normal but the males (25 dissections)

were sterile; in the F_3 generation, the females and 18 per cent. of the males (11 dissections) were normal. With females of race *melanoon*, the adults of the F_1 generation were healthy and vigorous; the females were normal, but the males (30 dissections) were sterile. The females and 8·3 per cent. of the males (12 dissections) of the F_2 generation were normal. With females of race *labranchiae*, adults of the F_1 generation were healthy and vigorous; the females were normal, but the males (31 dissections) were sterile. The females of the F_2 generation and 20 per cent. of the males (33 dissections) were normal.

Although de Buck & Swellengrebel stated in a paper already noticed [23 214] that their "Italian *messeae*" corresponded to Hackett's *melanoon*, the author and Hackett have now come to the conclusion that it corresponds more closely to the race that in this paper has been called *subalpinus*. The typical eggs of *subalpinus* (black and white) and of *melanoon* (uniform dark grey) are strikingly different, but intermediate forms appear to occur in central Italy, and it is possible that these two types are merely geographical variations.

ZON (B. K.). **Zoutwatervischvijvers en malaria.** [Salt-water Fish-ponds and Malaria.]—Geneesk. Tijdschr. Ned.-Ind. 79 pt. 9 pp. 529–540, 14 refs. Batavia, 1939.

The author reviews various methods that have been adopted or suggested to control the breeding of *Anopheles sundaicus*, Rdnw. (*Iudlowi*, auct.) in salt water fish-ponds on the north coast of Java [cf. R.A.E., B 9 36; 12 177; 13 147]. It was found that when the ponds were periodically laid dry [cf. 18 185], the growth of blue algae was insufficient for the requirements of the fish. The practice has now been adopted in many cases of manuring the bottom of the ponds with organic material obtained by composting marginal vegetation and algae out of the ponds themselves, no periodic draining being carried out. In ponds in which the salinity of the water is low, however, there is a luxuriant growth of surface algae which has to be removed to prevent Anopheline breeding. Measures are adopted to increase the salinity, either by increasing the inflow of sea water or by preventing the inflow of surface water from the land side. In the case of a few ponds, dusting with Paris green is resorted to. This kills the mosquito larvae without injury to the fish or algae.

AUSTEN (E. E.). **The Housefly as a Danger to Health. Its Life-history and how to deal with it.**—Econ. Ser. Brit. Mus. (Nat. Hist.) no. 1, 4th edn revd by J. Smart, 25 pp., 11 figs., 8 refs. London, 1939. Price 6d.

The changes that have been made in this pamphlet on *Musca domestica*, L., the first edition of which has been previously noticed [R.A.E., B 1 66], are concerned chiefly with the measures of control, much of the additional information being taken from a more comprehensive pamphlet on the same subject [16 229].

Notes on Animal Diseases. I. Redwater and Anaplasmosis.—E. Afr. agric. J. 4 no. 4 pp. 297–303. Nairobi, 1939.

In the course of this paper on redwater and anaplasmosis in cattle in Kenya (where they are caused by *Piroplasma bigeminum* and

Anaplasma marginale, respectively), their transmission is discussed. The most important vector of the former is the one-host tick, *Boophilus annulatus decoloratus*, Koch, which may retain the infection after having been reared for several generations on hosts that are not susceptible. Hereditary transmission has also been demonstrated in a two-host tick, *Rhipicephalus bursa*, C. & F., in which the infection was transmitted to cattle by adults derived from infected immature stages fed on a horse. *R. appendiculatus*, Neum., and *R. evertsi*, Neum., are less effective vectors, in which hereditary transmission has not been shown to occur. *B. annulatus decoloratus* is also the most important East African vector of anaplasmosis, which can be transmitted by ticks of the genera *Amblyomma*, *Hyalomma*, *Dermacentor*, *Ixodes* and *Rhipicephalus*. Hereditary transmission has, however, only been proved to occur in *R. simus*, Koch, in some varieties of *B. annulatus*, and in *Ixodes ricinus*, L., a species that does not occur in East Africa ; it is doubtful in *R. bursa* and *R. appendiculatus*.

PAPERS NOTICED BY TITLE ONLY.

- COOLEY (R. A.) & KOHLS (G. M.). *Amblyomma philipi—a new Tick from Texas and Mexico, with a Key to known Species of Amblyomma in the United States (Acarina : Ixodidae)*.—*Publ. Hlth Rep.* **54** no. 2 pp. 44–47, 2 pls., 4 refs. Washington, D.C., 1939.
- ABDUSSALAM (M.). *On a new Feather Mite [Rivoltasia karamellahieei sp. n.] parasitic on the Indian Domestic Fowl (Gallus bankiva murghi)*.—*Vet. J.* **95** no. 1 pp. 39–42, 7 refs. London, 1939.
- IYENGAR (M. O. T.). *Egg of Anopheles leucosphyrus DöN.*—*J. Malar. Inst. India* **1** no. 4 pp. 353–354, 1 pl., 4 refs. Calcutta, 1938.
- MENON (M. A. U.). *A Trematode [Agamodistomum sp.] parasitic in Anopheles Mosquitos [Anopheles culicifacies, Giles, in S. Travancore]*.—*J. Malar. Inst. India* **1** no. 4 pp. 391–394, 1 pl., 6 refs. Calcutta, 1938.
- RAMACHANDRA RAO (T.) & RUSSELL (P. F.). *Some Field Observations on the Swarming and Pairing of Mosquitoes, particularly A. annularis, in South India*.—*J. Malar. Inst. India* **1** no. 4 pp. 395–403, 2 pls., 10 refs. Calcutta, 1938.
- SEN (P.). *The early Stages of Aëdes lophoventralis (Theobald)*.—*Rec. Indian Mus.* **40** pt. 4 pp. 359–361, 2 figs., 1 ref. Calcutta, 1938.
- EDWARDS (F. W.). *A new East African Aëdes [A. (Finlaya) pulchrithorax from Kenya] (Dipt. Culicidae)*.—*Proc. R. ent. Soc. (B)* **8** pt. 2 p. 17, 1 fig. London, 1939.
- MACDONALD (E. C.). *The Larva of Aëdes (Finlaya) pulchrithorax Edwards (Dipt. Culicidae)*.—*T.c.* pp. 17–18.
- ROBINEAU (—). *Instruction récapitulative sur la prophylaxie anti-amarile au Sénégal*.—*Ann. Méd. Pharm. colon.* **36** no. 4 pp. 914–945, 2 figs. Paris, 1938.
- GRAHAM-SMITH (G. S.). *The Generative Organs of the Blowfly, Calliphora erythrocephala L., with special Reference to their Museulature and Movements*.—*Parasitology* **30** no. 4 pp. 441–476, 16 figs., 10 refs. London, 1939.

WHITMAN (L.). **Failure of *Aëdes aegypti* to transmit Yellow Fever Cultured Virus (17D).**—*Amer. J. trop. Med.* **19** no. 1 pp. 19–26, 3 refs. Baltimore, Md., 1939.

It has been found that the strain of yellow fever virus (17D) used in the preparation of vaccine in Brazil has been modified by prolonged cultivation in tissue culture until it has lost the greater part of both its viscerotropic and neurotropic affinities, but since at times living virus can be recovered from the blood stream of vaccinated persons, it was thought advisable to test the capacity of *Aëdes aegypti*, L., to become infected with this strain.

The following is substantially the author's summary : The quantity of virus in the circulation of a vaccinated human being is too small under most circumstances to permit the infection of *A. aegypti*. Eight volunteers were examined on the sixth and seventh days after vaccination, but virus was only detected in the blood of two ; these both showed minimal amounts on the 7th day ; mosquitos fed on all of them at that time were not infected. Of 12 batches of mosquitos fed on vaccinated monkeys (*Macacus rhesus*), five engorged at a time when the concentration of virus in the blood stream was as great as or greater than that observed in a carefully studied group of 29 human beings after vaccination. None of the five batches was infected. Attempts were made to infect larvae by immersing them in four different concentrations of vaccine virus [cf. *R.A.E.*, B **26** 139]. Adults derived from the batches of larvae placed in the two highest concentrations (titres 202,000 and 496,000) were shown by injection into mice and monkeys to be infected, but none was capable of transmitting the virus by bite. Batches of 35 and 29 females failed to transmit the virus by biting, although the identical mosquitos were shown to contain the virus. None of the three monkeys infected by injections of the mosquitos had fever, nor was there any increase in circulating virus as a result of the single passage through the bodies of the mosquitos. It is concluded that there is probably no danger of *A. aegypti* transmitting the 17D vaccine virus.

RILEY (W. A.). **The Rôle of Insects and allied Forms in the Transmission of Diseases due to Filterable Viruses.**—*Minn. Med.* **21** pp. 817–821, 1 ref. St. Paul, Minn., 1938.

The author discusses the work that has been done on the relation of insects to the transmission of various diseases caused by filterable viruses, with particular reference to equine encephalomyelitis in Minnesota. He points out that in this State during the five summers preceding 1938 approximately 50,000 horses were affected, of which about 10,000 died. Moreover, cases of encephalitis in man in Minnesota and Massachusetts have been shown to be due to the virus of equine encephalomyelitis of the western and eastern strains respectively. Experimental transmission has been obtained with *Aëdes aegypti*, L., *A. albopictus*, Skuse, *A. cantator*, Coq., *A. sollicitans*, Wlk., *A. taeniorhynchus*, Wied., *A. dorsalis*, Mg., *A. nigromaculatus*, Ludl., and *A. vexans*, Mg., of which the last three occur commonly in Minnesota, *A. vexans* being the most abundant.

The following is based on the author's summary : The epidemiological evidence indicates that Arthropod vectors play a part in the spread of the disease to animals and man. Mosquitos of the genus *Aëdes* most nearly fulfil the requirements for this transmission, and there

is conclusive evidence that the virus may multiply in them and be transmitted to healthy laboratory animals and to horses. There is no satisfactory evidence that other Arthropods are implicated, except possibly under very exceptional conditions. On the other hand, mosquitos have never been found infected in nature, and since the potential mosquito vectors do not overwinter as adults and diseased horses are only infective during the first few days of the attack, there is no obvious explanation of the survival of the virus through the winter. The readiness with which the virus is transmitted by the nasal route suggests that there are other methods of spread.

TOUMANOFF (C.). **Le paludisme des buffles peut-il fausser les indices oocystiques et sporozoitiques en Indochine?**—*Bull. Soc. Path. exot.* **32** no. 1 pp. 80–87, 11 refs. Paris, 1939.

In this paper, the author replies to criticisms by E. Brumpt [R.A.E., B **26** 253] of his article on the finding of sporozoites of human malaria in two females of *Anopheles minimus*, Theo., taken in Cambodia and dissected after feeding several times on animals [**26** 61]. He gives reasons for considering improbable Brumpt's hypothesis that the infections were due to *Plasmodium bubalus* (a parasite not known to occur in Indo-China), including the fact that one of the mosquitos in question was fed on an ox and not a buffalo, a point that he admits was not made clear in his original paper. With regard to Brumpt's contention that the parasites of human malaria could not have persisted for so long, he gives in detail numerous observations made in Indo-China in both the warm, wet and dry, cold seasons, which show that the development of the malaria parasites in the mosquito may be retarded, even when the temperatures appear to be favourable; in certain cases, mosquitos dissected as long as 20 days after collection contained developing oöcysts or mobile sporozoites. Several possible explanations of this phenomenon are discussed. It does not seem to be easy, at least in Indo-China, to determine exactly the age of an oöcyst from its appearance.

VAN THIEL (P.) & BEVERE (L.). **Preuve expérimentale de l'anthrophilie d'*Anopheles maculipennis labranchiae* et *elutus*.**—*Bull. Soc. Path. exot.* **32** no. 1 pp. 103–109, 5 refs. Paris, 1939.

Since the first apparatus designed for testing the food preferences of races of *Anopheles maculipennis*, Mg. [cf. R.A.E., B **24** 225] did not appear to give satisfactory results in the Mediterranean region [cf. **25** 170], a second one was designed in which conditions were less artificial. In this, the boxes for the man and the pig were placed in a large insectary, the mosquito cage and the connecting pipes were dispensed with, and mosquito traps were placed over the doors of the boxes. The mosquitos to be tested were released in the insectary and caught in the trap over whichever box they tried to enter. This apparatus was first used in tests with race *atroparvus*, van Thiel, at Leyden. The results showed clearly that this race is zoophilous, the average ratio of females attracted to pig and man, respectively, being 12 : 1, and that it is not, as indicated by the first apparatus, the higher temperature that determines the choice [cf. **24** 225]. Experiments with the same apparatus were then undertaken on the Adriatic coast of Italy with races *labranchiae*, Flni., and *sacharovi*, Favr (*elutus*, Edw.). Various

difficulties encountered in carrying out these experiments are discussed. On an average, 2·2 times as many females of race *labranchiae* and 2·4 times as many of race *sacharovi* were attracted to man as to pig, so that, at least when the alternative is the local type of pig, these races show a definite preference for man. In only one experiment were the numbers attracted to man and pig approximately equal. Since the man in the two series of experiments was the same, the differences in behaviour observed in the three races would appear to be attributable to differences in their biology rather than to differences in the relative attractiveness of pigs in Holland and Italy, which appeared to be similar. From these results, it is concluded that pigs would afford little protection to man from the attacks of *A. maculipennis* in Italy or any other country where races *labranchiae* and *sacharovi* occur, whereas they are of considerable value in this respect in Holland.

BAISAS (F. E.). Notes on Philippine Mosquitoes, VII. A—*Culex* (*Culex*) with banded Proboscis and Tarsi. B—*Anopheles*: the Pupae of three rare Species; the *leucosphyrus*-subgroup.—*Mon. Bull. Bur. Hlth Philipp. I.* **18 no. 5 pp. 175–232, 18 pls., 12 figs., 22 refs. Manila, 1938.**

The first section of this paper, which deals with larval, pupal and adult characters, includes descriptions of 7 new species from the Philippines. In the second section are given the pupal characters of *Anopheles aitkeni* var. *bengalensis*, Puri, *A. insulaeflorum*, Sw. & Sw. de G., and *A. kolambunganensis*, Baisas, and a key to the pupae of the members of the series *Anopheles* occurring in the Philippines, which comprise the first two of these, *A. gigas* var. *formosus*, Ludl., and *A. lindesayi* var. *benguetensis*, King. The characters by which the adults of *A. cristatus*, King & Baisas, *A. leucosphyrus*, Dön., and its varieties, *balabacensis*, Baisas [R.A.E., B **24** 234] and *riparis*, King & Baisas [**24** 223], and the larvae and pupae of the first three forms may be distinguished from one another are discussed. The larva of var. *riparis* cannot be distinguished from that of the typical form, and the pupa is unknown.

EJERCITO (A.). Report of Inspection in Malaria Control Unit no. 3 with Headquarters at Callang, Dalig-Ziffu Region, Isabela.—*Mon. Bull. Bur. Hlth Philipp. I.* **18 no. 6 pp. 249–259, 12 figs. Manila, 1938.**

An account is given of the progress of the work that is being carried out for the control of malaria in the Dalig-Ziffu region of Isabela, where the vector is *Anopheles minimus* var. *flavirostris*, Ludl. The measures employed comprise the clearing and channelling of streams and the sloping of their banks, herbage cover [*cf. R.A.E.*, B **25** 46, etc.] and dusting with Paris green. In a section of a stream where the work had been completed, no larvae of *A. m. flavirostris* were found, whereas outside the controlled area larvae, pupae and adults were abundant. In the controlled section of one stream, *A. m. flavirostris* was found to have been replaced by the harmless species, *A. vagus* var. *limosus*, King. In the three areas where control work has been completed, the significant reduction in the density of the larvae of *A. m. flavirostris* has been followed by an equally significant reduction in the numbers of adults caught in traps. There appears also to have been a

reduction in the number of cases of malaria in the area in which the work was completed first, but it is not yet possible to draw definite conclusions regarding the other two areas.

URBINO (C. M.). Malaria Control and Agricultural Settlements.—
Mon. Bull. Bur. Hlth Philipp. I. **18** no. 7 pp. 301–323, 1 map,
 3 charts, 32 refs. Manila, 1938.

The author gives figures for the malaria incidence and for the density of *Anopheles minimus* var. *flavirostris*, Ludl. (as indicated by catches in a man-baited trap and in day-time resting places of the adults), which show the reduction that took place in both in an agricultural settlement near Manila after the institution of certain anti-mosquito measures. Day-time resting places were eliminated by clearing vegetation from the edges of streams and sloping their banks. Pigs and ducks were raised, and the water in the stream was kept muddy by the feeding of the former along the banks and by the wallowing of the latter during the hot weather. Larger domestic animals were also introduced, and more than 60 per cent. of the estate was brought under cultivation. Mosquito nets were also used regularly.

He suggests that the transmission of malaria on farms in the Philippines could be reduced by screening and by educating the people to use mosquito nets [cf. *R.A.E.*, B **22** 146]. The importance of considering the proximity of day-time resting places of Anophelines when selecting housing sites is emphasised, and the divergent opinions on the value of domestic animals in attracting Anophelines away from man are discussed [cf. **21** 230].

DE LA PAZ (G. C.). The Bacterial Flora of Flies caught in Foodstores in the City of Manila.—*Mon. Bull. Bur. Hlth Philipp. I.* **18** no. 8 pp. 393–412, 28 refs. Manila, 1938. **The Breeding of Flies in Garbage and their Control.—***T.c.* no. 10 pp. 515–519. **The Fly Problem in Relation to Refuse Disposal in Manila.—***T.c.* no. 10 pp. 521–539, 5 pls., 13 refs.

The first paper gives the results of examinations of cultures from the surface or interior of the bodies of flies caught weekly from 20th May to 18th October 1937 in restaurants, markets, food shops, hospital wards and other premises in Manila. The great majority of the flies examined belonged to the genus *Musca*; flies belonging to the other genera (*Sarcophaga* and *Chrysomyia*) were encountered so infrequently and were so few in number that for practical purposes they were considered unimportant. The isolation of various pathogenic and putrefactive bacteria confirms the conclusions of workers in other countries that flies are concerned in the transmission of human diseases, and that their presence, particularly in establishments where food is handled, is a menace to health.

In the second paper a list, in their order of abundance, is given of the flies that breed in garbage; the first three are *Musca domestica vicina*, Macq., *M. sorbens*, Wied., and *M. nebulo*, F. Investigations of all possible sources of fly-breeding in Manila and its suburbs indicated that garbage is the principal breeding material. Breeding does not take place in horse-dung, probably because it dries too quickly in a tropical climate. An outline is given of measures for the control of flies, most of which are taken from the publications of E. E. Austen [cf. *R.A.E.*, B **16** 229; **27** 159].

The means of disposing of refuse, which from the foregoing papers is obviously of considerable importance, is dealt with in the third paper. The system at present in use in Manila, the amount and types of refuse, and the cost of collection and disposal are discussed. It is suggested that the present dumping method should be replaced by a method of fermentation and reduction in zymothermic cells. The advantages of such a method are that the eggs, larvae, pupae, and even adults of flies, as well as pathogenic micro-organisms, are destroyed by the high temperature (60–70°C. [140–158°F.]) engendered in the cells, unsightly garbage dumps with their offensive odours are abolished, and the garbage itself is converted into fertiliser. The cost of installation and maintenance of the necessary plant is discussed, together with the estimated compensation that could be obtained from the sale of the fertiliser.

INABA (S.). On the salinity Tolerance of the Larva and Pupa of the Mosquito (*Ochlerotatus* sp.). [In Japanese.]—*Kontyû* **12** no. 6 pp. 216–219. Tokyo, 1938.

The larvae of a species of *Aëdes* (*Ochlerotatus*) are very common on rocky beaches at Shimoda, Shizuoka Prefecture. The salinity percentage of the water in the pools was generally less than 6, but was 35·1 in one of them and 56 in another. In experiments, larvae and pupae gave rise to adults in fresh and sea water, but last-instar larvae died within 10 hours in water containing over 12·8 per cent. sodium chloride, and very few pupated in water containing 7·1–9·9 per cent.

VANNI (V.). Ricerche sulla Leishmaniosi cutanea endemica degli Abruzzi. [Investigation on Cutaneous Leishmaniasis endemic in Abruzzi.]—*Ann. Igiene* **49** no. 2 pp. 65–67, 11 refs. Rome, 1939.

In view of evidence that *Phlebotomus perfoliatus*, Parr. (*macedonicus*, Adl. & Thdr.) may be a vector of *Leishmania tropica* in the Abruzzi [R.A.E., B **27** 62], the author inoculated a suspension of 200 examples of this sandfly into the tails of three white rats. After about 40 days one of the rats showed a nodule, smears from which contained parasites similar to those in lesions of oriental sore. The nodule also became ulcerated in the same way as the lesions on man.

BARTELS (E.). Ein Streifzug durch die Bekämpfung der Dasselfliegen-plage. [A Survey of Warble-fly Control.]—*Z. hyg. zool. Schädl.-Bekämpf.* **31** pt. 3 pp. 65–76, 6 figs. Berlin, 1939.

The author briefly reviews the development of the problem of warble-fly control in Germany and quotes a regulation dated 18th March, 1938, prescribing that all larvae of *Hypoderma bovis*, DeG., and *H. lineatum*, Vill., infesting cattle shall be killed in the period from February to 31st May. He states that up to 1937, control was in general unsatisfactory, and emphasises the necessity of further studies on the bionomics of the flies. The only available control measure is to destroy the larvae; the best insecticide is a suspension of derris in soap solution [cf. R.A.E., B **23** 36, 37], which kills the larvae at any stage of development of the warbles. The derris root should yield 8 per cent. rotenone and 25 per cent. residual extract, and two applications

of a 2 per cent. suspension, with a 2-day interval, are more effective than a single application of 4 per cent. suspension. Removal of the larvae mechanically is advisable only in slight infestations in small herds.

WIETING (J. O. G.) & HOSKINS (W. M.). **The Olfactory Responses of Flies in a new Type of Insect Olfactometer. II. Responses of the Housefly to Ammonia, Carbon Dioxide and Ethyl Alcohol.**—*J. econ. Ent.* **32** no. 1 pp. 24–29, 1 fig., 15 refs. Menasha, Wis., 1939.

It has been proved that response to volatile substances influences the feeding and oviposition habits of *Musca domestica*, L., but little quantitative data on its chemotropic reactions have been published, and a study of the available information indicates that the divergency of the conclusions reached by different workers has been due in many cases to their failure to take into account the varying concentrations, as a gas, of the substances being tested. This opinion was supported by experiments with flesh-flies [*Lucilia sericata*, Mg.], which showed that a substance attractive at a low concentration may be repellent at a higher one [cf. *R.A.E.*, A **23** 33]. For this reason experiments were undertaken with ammonia, carbon dioxide and ethyl alcohol in the olfactometer already described [*loc. cit.*], modified for use with house-flies. The method of rearing the flies and the technique employed in the experiments are described.

The following is the authors' summary: An olfactometer suitable for use with house-flies is described. It depends upon streams of air heated to 41°C. [105·8°F.] to attract the flies to the test and check areas. Concentration of the substance to be tested is controlled by the use of flowmeters and saturation chambers. The results show that mixed groups having a sex ratio of approximately unity are attracted to ammonia at a concentration of 0·012 per cent. by volume, but are strongly repelled at concentrations greater than 0·03 per cent. Carbon dioxide has no appreciable effect up to about 2 per cent. Ethyl alcohol attracts feebly at 0·012 per cent. and repels above about 0·05 per cent. With separated sexes, females are more strongly attracted than males to ammonia, and the reverse is the case with alcohol.

HULL (J. B.) & SHIELDS (S. E.). **Pyrethrum and Oils for Protection against Salt-Marsh Sand Flies (*Culicoides*).**—*J. econ. Ent.* **32** no. 1 pp. 93–94. Menasha, Wis., 1939.

An account is given of laboratory and field experiments carried out over a period of two years in Georgia and Florida, which showed that salt-marsh sandflies (*Culicoides*) may be excluded from houses by applying mixtures of concentrated pyrethrum extract and oil to the door and window screens. The pyrethrum concentrate was the extract of 20 lb. pyrethrum in 1 U.S. gal. refined kerosene, and the best mixtures were 1 part extract and 20 parts lubricating oil with a viscosity of about S.A.E. 5, and 1 part extract, 6 parts kerosene and 12 parts lubricating oil (S.A.E. 10). The mixture should be evenly and thoroughly applied with a brush or rag, and the rooms should then be well sprayed with standard pyrethrum extract spray to kill sandflies already inside the house. The treatment was reported to give protection for 24–48 hours.

GUNDERSON (H.) & STRAND (A. L.). **Toxicity of Hydrogen Cyanide, Chloropicrin and Ethylene Oxide to Eggs, Nymphs and Adults of the Bedbug.**—*J. econ. Ent.* **32** no. 1 pp. 106–110, 3 figs., 13 refs. Menasha, Wis., 1939.

An account is given of experiments undertaken to determine for 3 gases the concentrations that give 50 per cent. mortality of the different stages of *Cimex lectularius*, L., after exposure for 5 hours (5-hour median lethal concentration [*cf. R.A.E.*, A **20** 60]). The fumigation temperature was 25°C. [77°F.]. The technique is described, and the results are given in the form of regression lines calculated according to the methods of Bliss [A **23** 493]. The median lethal concentrations (in milligrams per litre) of hydrocyanic acid gas, chloropicrin and ethylene oxide were, respectively, 0.096, 4.613 and 0.242 for the eggs, 0.331, 1.870 and 1.291 for the nymphs, and 0.336, 2.233 and 1.803 for the adults. The chi-square tests showed that the results were consistent with those found by random sampling of a homogeneous population, except for the two curves representing the effects of chloropicrin and ethylene oxide on the eggs. These two curves, however, represent the best fit to the experimental data.

BRADLEY (G. H.). **A Consideration of some Phases of the Mosquito Control Programme.**—*J. econ. Ent.* **32** no. 1 pp. 110–112. Menasha, Wis., 1939.

The author discusses the control of mosquitos in relation to the problem of preserving waterfowl, musk-rats, etc., on marshes in the United States. He points out that the work should be justified by relief from annoyance by mosquitos or reduction in the incidence of mosquito-borne diseases, and not merely by an absence of damage to the marshes or their incidental improvement. Where a considerable population is affected or the development of a community is retarded owing to the abundance of mosquitos, it can usually be shown that the benefits derived from control work far outweigh any ill-effects on marshes in the vicinity. If such is not the case, the work should not be undertaken. It is desirable to invite the co-operation of competent conservation authorities in making preliminary surveys of the marshes and in working out methods for the reduction of possible injury to wild life.

BARTLETT (K. A.). **The Dung Rolling Beetle as a Host of a Sarcophagid Parasite.**—*J. econ. Ent.* **32** no. 1 p. 150. Menasha, Wis., 1939.

Two consignments of the dung-rolling beetle, *Canthon pilularius*, L., were sent by air from Texas to Porto Rico during July 1936. On their arrival, a number of Dipterous larvae and pupae were found in the cages, together with a number of dead beetles (most of which had the head and thorax broken away from the abdomen), and dissections of entire dead and living beetles disclosed a Dipterous parasite within the abdomen. Observations were made on the bionomics of the parasite, which was identified as *Sarcophaga alcedo*, Aldr. The females deposited living larvae, usually in pairs, either directly on the beetle or in dung. The total number of larvae produced by a single female ranged from 14 to 219. When larvae were deposited

in uninfested dung, they successfully parasitised beetles that were subsequently placed in it. The larvae were able to penetrate the integument of the beetle at any point, but most of them entered the more thinly chitinised portions of the abdomen. The larval stage lasted 3-7 days. The beetles usually died 2-3 days before the full-grown larva or larvae of the parasite emerged; as many as 7 larvae emerged from a single host. Flies did not larviposit on dead beetles and, although larvae were observed crawling on them, none was successfully reared. Apparently the mature larva is able by the movement of its body to break the abdomen of the host from the thorax and emerge from its anterior end. The larvae pupated within 24 hours of leaving the host, and the adults emerged 11-13 days later. In one case, two larvae pupated within the abdomen of the beetle. The adults lived as long as 44 days under laboratory conditions. They paired readily in cages immediately after emergence, and pairing was frequently observed thereafter. The gestation period was 12 days. *S. alcedo* is not specific in its host relationship; two examples of *Copris incertus*, Say, were successfully parasitised by it.

BARANOV (N.). Đubrišta kao legla muha u selu Mraclin. [Dung Heaps as Breeding Places of Flies in the Village of Mratzlin.]
[In Serbian.]—*Vet. Arhiv* 9 no. 5 pp. 280-287, 4 figs. Zagreb, 1939. (With a Summary in German.)

Investigations on the breeding of flies in dung heaps were carried out in 1932 and 1933 in a village near Zagreb where adult flies are numerous. Samples of dung from the open and from animal quarters were placed under conditions favourable for the development of flies, but adults of *Musca domestica*, L., *Stomoxys calcitrans*, L., *Fannia (Homalomyia) canicularis*, L., and *F. (H.) scalaris*, F., emerged only from the dung from the sheds, and then only in small numbers. The absence of the larvae from dung heaps in the open is probably due to their being destroyed by fowls, which are very numerous in the village.

LAL (R. B.), GHOSAL (S. C.) & MUKHERJI (B.). Investigations on the Variation of Vibrios in the House Fly.—Indian J. med. Res. 26 no. 3 pp. 597-609, 5 refs. Calcutta, 1939.

Views as to whether cholera vibrios vary in form are divergent. The question is of epidemiological importance since, if they are subject to material variations, their maintenance in an endemic region, or in an inter-epidemic period, in a form not readily recognisable would be possible, and if they are not, attention may be focussed on typical vibrios and atypical ones may safely be ignored. Since it has been suggested that flies may be concerned in the cyclical transmission of the vibrios [*cf. R.A.E.*, B 19 174], the experiments described in this paper were undertaken in Calcutta with a view to investigating what changes, if any, could be detected in vibrios after passage through flies of the genus *Musca*, using modern techniques.

The following is the authors' summary: Investigations have been carried out on the characters of vibrios isolated at intervals from house-flies fed on cultures of vibrios of different types. Certain changes in colonial characters and morphology of the strains are recorded. No changes in fermentation reactions of the sugars used in Heiberg's classification were noted, except a transient change in one case which

was lost on subsequent sub-culture. No change of "O" serological type was recorded in the case of *Vibrio cholerae* or other strains. Changes in metabolic activity and in chemical type as determined by the methods employed by Linton and his collaborators were found in the case of many of the strains recovered from flies. The observations given here are difficult to interpret in the light of our present knowledge of *V. cholerae*. No conclusions have, therefore, been drawn at this stage.

GAHAN (A. B.). Notes on some Genera and Species of Chalcidoidea (Hymenoptera).—*Proc. ent. Soc. Wash.* **40** no. 8 pp. 209-227. Washington, D.C., 1938.

The species dealt with in this paper [*cf. R.A.E.*, A **27** 434] include *Tachinaephagus zealandicus*, Ashm., a parasite of blowflies in New Zealand and Australia, of which *T. australiensis*, Gir., *Stenoteryx fulvoventralis*, Dodd, and *Australencyrtus giraulti*, Johnston & Tiegs, have been found to be synonyms.

WIGGLESWORTH (V. B.). The Principles of Insect Physiology.—Roy. 8vo, viii+434 pp., 316 figs. London, Methuen & Co., Ltd., 1939. Price, 30s.

In this text-book, the main emphasis throughout is on the functions of the organs and tissues ; descriptions of anatomy are reduced to the minimum needed to explain the physiological argument. It is designed to set out the general principles of insect physiology and to illustrate each physiological characteristic by a few concrete examples, with bibliographic references to guide the student to the more important sources of information. The author points out that, though it is not the purpose of physiology to furnish directly the means of insect control, the rational application of measures (whether these be insecticides or artificial interferences with the insect's environment) is often dependent on a knowledge of the physiology of the insect concerned. Physiology may thus serve to rationalise existing procedures, or to reveal the weak spots in the ecological armour of a species. A knowledge of the ecology of a species is always necessary for its effective control ; its ecology can be properly understood only when its physiology is known.

PEUS (F.). Die Flöhe. Bau, Kennzeichen und Lebensweise, Hygienische Bedeutung und Bekämpfung der für den Menschen wichtigen Floh-Arten. [Structure, Characters and Biology, hygienic Importance and Control of the Fleas of Importance to Man.]—*Hyg. Zool.* **5** 106 pp., 29 figs., 7 pp. refs. Leipzig, P. Schöps, 1938. Price, paper Mk. 4·80, cloth Mk. 6.

This monograph, which deals with fleas that infest man, or animals and birds that are associated with human dwellings, is intended for persons engaged on measures against them in Germany. The first of the two largest sections is on morphology and classification and includes a key to the more important species adapted from those of Wagner [*R.A.E.*, B **25** 16]. The second comprises an account of the biology of fleas in general, with incidental data on individual species, and contains an appendix on the collection and breeding of fleas and

the preparation of specimens. The importance of fleas as pests in Germany and as vectors of disease in various parts of the world and measures of control are dealt with in the last two sections.

[ТИФЛОВ (V. E.) & РОТАРОВ (V. D.).] **Тифлов (В. Е.) и Потапов (В. Д.). Migrations of Fleas of Ground Squirrels *Citellus pygmaeus* Pall.** [In Russian.]—Rev. Microbiol. 16 (1937) no. 3-4 pp. 438-466, 1 graph, 2 figs., 14 refs. Saratov, 1939. (With a Summary in English.)

In view of the importance in the Russian Union of fleas of rodents in the dissemination of plague, and to supplement investigations by other workers [*cf. R.A.E.*, B 24 53; 27 60], field observations on the migration of fleas from abandoned burrows of *Citellus pygmaeus* and on their survival under natural conditions were carried out in Western Kazakhstan from 1st August to 1st December 1934, and from 4th March to 15th November 1935. For this purpose, all the ground squirrels over an area of 25 acres were caught, and the fleas that tried to leave 50 burrows were trapped. The traps consisted of a metal box containing water which the fleas entered through a tube; the end of the tube was inserted into the entrance hole of the burrow. The results, which are tabulated, showed that all the species of fleas that occur on ground squirrels migrate from abandoned burrows. Species that have well developed eyes and infest the host itself (*Ceratophyllus tesquorum*, Wagn., and *Frontopsylla semura*, Wagn. & Ioff) markedly predominated, whereas those that have rudimentary eyes and inhabit the nests (*Neopsylla setosa*, Wagn., and *Ctenophthalmus pollex*, Wagn. & Ioff) were comparatively scarce. In 1934, most of the fleas migrated in August and only two in November. In 1935, the maximum number of fleas was caught in April, after which there was a sharp reduction, and only one flea was taken in July. After migration had ceased in July, 32 burrows were opened and examined for the presence of fleas; 19 live individuals were found, in 7 burrows. A few rodent fleas were caught outside burrows in 1935, and observations on batches of *N. setosa* showed that many could survive on the soil for 24 hours and a few for 48 hours or more.

[БАБЕНИШЕВ (V. P.) & others.] **Бабенишев (В. П.) [и другие]. Observations on the Fate of Fleas dwelling in the Nests of Ground Squirrels situated in the Regions that had been subjected to entire Poisoning.** [In Russian.]—Rev. Microbiol. 16 (1927) no. 3-4 pp. 467-474, 1 ref. Saratov, 1939. (With a Summary in English.)

An account is given of investigations in 1935 and 1936 in 8 districts of the Province of Ordzhonikidze (northern Caucasus) to determine whether fumigation of the burrows of ground squirrels [*Citellus pygmaeus*] with chloropicrin or calcium cyanide also destroys the fleas in them. The work was done in spring in localities in which all the burrows had been fumigated for two or three consecutive years; to ascertain the presence of fleas, the entrances of the burrows were opened and wads of cotton-wool were inserted into them and examined 24 hours later [*cf. R.A.E.*, B 24 53]. Fleas occurred on 44 wads out of 4,474 inserted in the morning (0·9 per cent.) and on 20 wads out of 3,182 inserted in the evening (0·62 per cent.). It was shown, however, by examining nests from treated and untreated burrows that the numbers of fleas were reduced by fumigation. The

average numbers per nest were 15.7 in fumigated burrows that still retained the straw plug and were covered with earth, 31.3 in fumigated burrows that had been opened for some time and may have been used by various small animals, and 49 in the untreated inhabited burrows.

Fleas collected from the ground squirrels belonged to 14 different species, the abundance and local distribution of which are shown in a table. They included *Ceratophyllus (Oropsylla) ilovaiskii*, Wagn. & Ioff, which had not previously been recorded from the northern Caucasus.

[FEDINA (O. A.).] **Федина (О. А.). To the Question of Extermination of Fleas by Beetles.** [In Russian.]—Rev. Microbiol. **16** (1937) no. 3-4 pp. 475-477. Saratov, 1939. (With a Summary in English.)

Various beetles as well as fleas were found in nests of *Citellus pygmaeus* in the Province of Ordzhonikidze (northern Caucasus) in 1936, and laboratory experiments with the species taken showed that two of them, the Staphylinid, *Philonthus scribae*, Fauv. [cf. R.A.E., B **27** 59], and the Histerid, *Gnathoncus rotundatus* var. *suturifer*, Reitt., were predaceous on the adult fleas and their larvae. *Gnathoncus* was first found in the nests at the end of April and became very abundant in May. In June and July its numbers decreased sharply, and at the beginning of autumn it disappeared from the nests, and entered the sand and litter for hibernation.

MICHAELIS (—). **Die Pferdelaus und ihre Bekämpfung.** [The Horse Louse and its Control.]—Z. Veterinärk. **48** pp. 385-401, 426-443, 20 refs. Berlin, 1936. [Recd. 1939.]

Haematopinus asini, L. (*equi*, Simmonds) is prevalent on army horses in Germany and is difficult to eradicate. The author reviews data from the literature on its biology and the measures that have been advocated against it, none of which has proved entirely effective, and gives the results of his own tests with several preparations. They included a proprietary German product known as "Cuprex" and containing a copper compound in an organic solvent, which has been reported to be highly effective against this louse and other vermin on animals, but which did not prove entirely reliable and was costly. The most effective was a mixture in water of nicotine (to kill the lice) and glacial acetic acid (to kill the eggs). The formula finally found satisfactory was 3 parts crude nicotine (96 per cent.), 50 parts glacial acetic acid (96 per cent.) and 1,000 parts water. This was well rubbed into the coat, and one application was sufficient. It was applied twice as a spray to harness and other leather gear, with an 8-day interval, while saddle cloths, girths, etc., were treated with steam for 1 hour at 100°C. (212°F.). The stables were washed out with a hose, and then with a solution of sodium carbonate in hot water, and this was followed by thorough scrubbing with a pailful of a fluid made up of 8 parts water, 2 parts saponified cresol, and 2 parts ordinary vinegar. As a result of this treatment, the horses remained free from lice up to the time of writing, 4 months later. Permanent disinfection is therefore possible in modern stables, but not in buildings containing much old woodwork.

In other experiments, lice taken from a horse and placed in open glass tubes in a warm room began to die in one day, and none was alive on the third day. Lice similarly kept at a low temperature (8°C. [46·4°F.]) became dormant, but though they survived for some time, all were dead after 5 days. Lice in stables, blankets, etc., are therefore certain to be dead after 8 days if deprived of food. Lice exposed to heat in glass tubes were still active at 45–50°C. [113–122°F.], but appeared dead at 53°C. [127·4°F.]. They revived at room temperature, but when exposed to a temperature of 58–60°C. [136·4–140°F.] for 10 minutes became motionless and did not revive. Lice placed on parchment paper and moistened by a mist spray of water became motionless and remained so on drying after a few hours, but became active when warmed near a stove. Lice on horses wetted with water at first appeared lifeless, but when the water had evaporated, the warmth of the horses revived them.

**MAIL (G. A.) & GREGSON (J. D.). Tick Paralysis in British Columbia.—
Canad. med. Ass. J. 39 pp. 532–537. Toronto, 1938.**

The authors discuss tick paralysis in man in British Columbia [*cf. R.A.E.*, B 25 178], giving notes on the habits of the tick, *Dermacentor andersoni*, Stiles, on the symptoms in man, on the theories regarding the cause, on the ulcers that sometimes occur at the site of the bite and on popular fallacies concerning the tick. Records of 150 cases are to be found in the files of the Dominion Entomological Branch Laboratory at Kamloops, B.C., and summaries of 27 of these are given in a table.

TRAGER (W.). Acquired Immunity to Ticks.—*J. Parasit.* 25 no. 1 pp. 57–81, 3 pls., 35 refs. Lancaster, Pa, 1939.

The following is the author's summary : One infestation of guineapigs or rabbits with larvae of the American dog tick, *Dermacentor variabilis*, Say, induces an acquired immunity which effectively prevents subsequent batches of larvae from engorging. In guineapigs, the immunity develops fully within two weeks after the start of the first infestation and lasts at least three months. Guineapigs first infested with either *D. variabilis* or *D. andersoni*, Stiles, show a cross immunity to larvae of the other species. Similarly, rabbits first infested with either *D. variabilis* or *Haemaphysalis leporis-palustris*, Pack., show cross immunity to larvae of the other species. Deer mice [*Peromyscus*] become relatively resistant to larvae of *D. variabilis* after two or three infestations. The repeated infestation of guineapigs with nymphs or adults of *D. variabilis* results in a marked reduction in the amount of blood taken by the ticks of later batches. The immunity of guineapigs to larvae of *D. variabilis* can be produced artificially by the intracutaneous inoculation of an extract of larval ticks. It can be passively transferred by the intraperitoneal inoculation of serum from guineapigs hyperimmunised by repeated infestations with nymphs. In the ears of non-immune guineapigs, on the fourth day after attachment of a larva of *D. variabilis*, there is little cellular reaction at the site of attachment. In immune animals, there is present by the fourth day an intense inflammatory reaction. The mouthparts of the tick are met by a solid mass of leucocytes, and the epithelium has thickened and

begun to grow beneath the leucocytic mass. In this way, the tick becomes walled off from its source of supply of blood before it can engorge.

[AFANAS'EV (S. F.).] Афанасьев (С. Ф.). Essai d'utilisation du distillat d'alambics à coke (solare) dans la lutte contre les larves de l'*Anopheles maculipennis*. Communication préliminaire. [In Russian.]—*Med. Parasitol.* 7 no. 5 pp. 694–700. Moscow, 1938.

An account is given of oiling experiments against larvae of *Anopheles maculipennis*, Mg., carried out in May 1938 in northern Caucasus with a distillate obtained from stills in which one of the residues from crude petroleum is converted into coke. It proved completely effective in the laboratory and in tests on a small scale in the field, but the author considers that further work is necessary with a view to standardising it, as different samples vary considerably in composition, and the aromatic hydrocarbons of which it mainly consists are characterised by great instability.

[BIRYUKOV (V. I.).] Бирюков (В. И.). Contribution au problème de l'action dynamique de l'eau comme moyen de lutte contre les larves et les pupes du moustique *Anopheles* dans de différentes conditions écologiques. [In Russian.]—*Med. Parasitol.* 7 no. 5 pp. 701–715, 6 graphs, 3 refs. Moscow, 1938. (With a Summary in French.)

A detailed account is given of preliminary experiments carried out in August 1936 in southern Ukraine to determine the effect of flowing water on larvae and pupae of *Anopheles maculipennis*, Mg. [cf. *R.A.E.*, B 25 269]. For this purpose, counted numbers of larvae and pupae were transferred from a river to different points along two irrigation canals. One of these was free from vegetation, but different plants, both submerged and rising above the surface of the water, were growing on the sloping banks of the other. In certain sections of the first canal, submerged *Ceratophyllum* was planted along the banks and in some cases on the bottom as well. The flow of water was regulated by shields, and its action was estimated by expressing the number of larvae and pupae taken along the banks of the canals as a percentage of their initial number and comparing it with the percentage carried by the water into catching bags fixed on a tray at the end of the canal. The results, which are tabulated, showed that allowing the water to flow for two hours at rates varying from 8 to 20 ins. per second did not appreciably reduce the numbers of larvae and pupae, whereas allowing it to flow at the same rates periodically (for from 20 seconds to 30 minutes at intervals of from 40 seconds to 30 minutes) was considerably more effective. Good results were obtained when sudden fluctuations of from 2 to 8 ins. in the level of the water were produced by draining [cf. 24 131]. When the changes in the water level were produced quickly, only 3·2–9·2 per cent. of the larvae and pupae were recovered, either from the catching bags or from near the banks, but when they were produced slowly, only 21·2 per cent. were destroyed. Raising the level of the water gradually and allowing it to flow into small ditches made in the sides of the canal to trap the larvae and pupae gave promising results.

[SHLENOVA (M. F.).] Шленова (М. Ф.). Vitesse de la digestion du sang par la femelle de l'*Anopheles maculipennis messeae* aux températures effectives constantes. [In Russian.]—*Med. Parasitol.* 7 no. 5 pp. 716–735, 3 graphs, 9 refs. Moscow, 1938. (With a Summary in French.)

An account is given of laboratory experiments on blood-digestion in females of *Anopheles maculipennis*, Mg., race *messelae*, Flni., carried out in Moscow from 20th February 1934 to 20th February 1935 at temperatures ranging from 5·5 to 40°C. [41·9–104°F.] and relative humidities of 30–40, 70–80 and 90–100 per cent. Females of the overwintering generation were taken in hibernation quarters, and those of summer generations were bred from larvae and pupae collected in the field. The process of blood-digestion is described in detail from observations made on 1,728 individuals fed on a rabbit. The temperature most favourable for survival of the mosquitos was 20°C. [68°F.]. The most favourable humidity was 90–100 per cent. at this and higher temperatures and 70–80 per cent. at lower ones. The highest temperatures at which mosquitos were able to complete digestion were between 30 and 35°C. [86–95°F.] in the case of the hibernating generation and between 35 and 40°C. [95–104°F.] in the case of the summer ones.

The temperatures most favourable for the maturation of the ovaries in females that did not diapause were between 20 and 25°C. [68–77°F.]. Of the females of the hibernating generation that completed digestion, only 28·2 per cent. possessed mature ovaries after a single blood meal in November, whereas in December the percentages were 42·7, 59·3 and 71·5 at 15, 20 and 30°C. [59, 68 and 77°F.], respectively. From January onwards, the diapause practically ceased and the percentage of females in which the ovaries matured increased greatly.

Blood-digestion was accelerated by a rise in temperature up to 30°C., but was retarded at 35°C. At temperatures above 15°C., it was accelerated by high humidity, probably because evaporation at low humidities reduced the body-temperature of the mosquito. At optimum temperatures, digestion and maturation of the ovaries were usually completed in about 44 hours, but in some individuals the entire process occupied only 24 hours. In small mosquitos blood was digested more quickly than in large ones.

[VLADIMIROVA (M. S.) & SMIRNOV (E. S.).] Владимирова (М. С.) и Смирнов (Е. С.). Concurrence vitale dans une population homogène de *Musca domestica* L., de *Phormia groenlandica* et entre ces deux espèces. [In Russian.]—*Med. Parasitol.* 7 no. 5 pp. 755–777, 12 graphs, 7 refs. Moscow, 1938. (With a Summary in French.)

The effect of overcrowding and lack of food on larvae of *Musca domestica*, L., and *Phormia terraenovae*, R.-D. (*groenlandica*, Zett.) was studied in Moscow by placing different numbers of newly hatched larvae on pieces of liver each weighing 5 gm. [*cf. R.A.E.*, B 23 109] and ascertaining the numbers of pupae produced, the average weights of the pupae and the biomass (total weight of all the pupae of the batch). In the case of *M. domestica*, there was no evidence of competition in batches of up to 70 larvae. With batches of 70–200 larvae, the average pupal weight decreased, though the biomass continued to increase. With more than 200 larvae, the number and

biomass of the pupae also decreased. In tests with 550, 600 and 700 larvae, the mortality percentages were 96·2, 98·1 and 99·1, respectively.

In experiments with *P. terraenovae*, the effects of competition become evident with smaller batches of larvae owing to their larger size. Apart from this, however, *M. domestica* appeared better able to survive adverse conditions well enough to produce dwarf pupae, and in experiments in which the two species were tested in competition with each other it survived in small numbers when *Phormia* did not.

[SHAPKIN (L. A.).] ШАПКИН (Л. А.). Contribution au problème de l'influence exercée par les oiseaux aquatiques sur l'anophélologie des collections d'eau. [In Russian.]—*Med. Parasitol.* 7 no. 5 p. 778. Moscow, 1938.

Instances are cited of elimination of the larvae of *Anopheles* and *Culex* from pools in different districts in southern Ukraine and near the estuary of the Dnieper by wild aquatic birds, which destroyed the submerged vegetation and rendered the water turbid. This suggests the value of domestic ducks in the control of Anopheline larvae.

DEL VECCHIO (G.). Sulle varietà di *A. claviger (bifurcatus)*. Nota I. [On the Varieties of *Anopheles claviger*. I.]—*Riv. Parassit.* 3 no. 1 pp. 27-37, 1 pl. Rome, 1939. (With Summaries in French, English and German.)

Further work, from September 1937 to October 1938, on the eggs of *Anopheles algeriensis*, Theo., and *A. claviger*, Mg., in the province of Littoria, Italy [*R.A.E.*, B 26 130], has shown that those agreeing with Sergent's figure and previously considered to be a race of *A. algeriensis* [*cf. loc. cit.*] belong to a new variety of *A. claviger*, which the author names var. *missiroli*. The variety of which the eggs resembled those ordinarily identified as *A. claviger* is named var. *petragnani*, n. Characters, based mainly on the intercostal spaces of the floats, are given distinguishing the eggs of the two varieties.

TONELLI RONDELLI (M.). Ixodoidea. Parte II. Contributo alla conoscenza della fauna ixodologica sud-americana. [A Contribution to the Knowledge of the South American Fauna of Ixodoidea.]—*Riv. Parassit.* 3 no. 1 pp. 39-55, 7 figs., 12 refs. Rome, 1939. (With Summaries in French, English and German.)

The author gives the results of a study of ticks collected by Beccari in British Guiana and Trinidad, and of a re-examination of those collected in Brazil by Balzan and studied by Berlese in 1888. She corrects some of Berlese's identifications. Four new species of *Amblyomma* are described from British Guiana.

CORRADETTI (A.). Studi morfologici sulla specie anofelica precedentemente identificata come *A. dthali* nel Semien e sua classificazione come nuova varietà di *A. rhodesiensis*. Morphological Studies on the Anopheline previously identified as *A. dthali* and its Classification as a new Variety of *A. rhodesiensis*.—*Riv. Parassit.* 3 no. 1 pp. 57-63, 1 fig., 3 refs. Rome, 1939. (With Summaries in French, English and German.)

The examination of further specimens of the Anopheline taken in the region of Semien, Abyssinia, that was previously identified as

Anopheles dthali, Patton [R.A.E., B 26 129] showed that although the adult is externally indistinguishable from that of the Asiatic *A. dthali*, the characters of the larva, pupa and pharynx show a greater affinity with those of *A. rhodesiensis*, Theo. As, furthermore, individuals agreeing in all respects with the description of *A. dthali* were also taken in the region of Uollo Jeggiu, the author considers that the intermediate form is a variety of *A. rhodesiensis*, which he names var. *dthalisimilis*, n. The pupa is described, and characters differentiating the adult and pupa of *A. rhodesiensis* from those of the new variety are given.

PAPERS NOTICED BY TITLE ONLY.

ROUBAUD (E.), COLAS-BELCOUR (J.) & MATHIS (M.). **Transmission de**

Plasmodium gallinaceum par *Aëdes geniculatus*.—*Bull. Soc. Path. exot.* 32 no. 1 pp. 28–30, 6 refs. Paris, 1939. [Cf. R.A.E., B 25 121; etc.]

SENEVET (G.) & COLLIGNON (E.). *Aëdes caspius aux environs d'Alger*.—*Bull. Soc. Hist. nat. Afr.* 29 no. 8 p. 528. Algiers, 1939.

VAN LOGHEM (J. J.). **The Plague Problem in the Netherlands Indies** [review].—*Bull. colon. Inst. Amst.* 2 no. 2 pp. 131–143, 7 refs. Amsterdam, 1939.

[IOFF (I. G.) & TIFLOV (V. E.).] **Иофф (И. Г.) и Тифлов (В. Е.). Materials for the Study of Fleas. III. Genus *Amphipsylla* Wagn. 1908.** [Revision, including 2 new species and 3 new subspecies.] [In Russian.]—*Rev. Microbiol.* 16 (1937) no. 3–4 pp. 401–437, 104 figs., 1 fldg table, 3 refs. Saratov, 1939. (With a Summary in German.)

STELLA (E.). **Per una migliore conoscenza delle zecche italiane. Risposta a Maria Tonelli Rondelli.** [A Contribution to the better Knowledge of Italian Ticks. A Reply to the criticism of Maria Tonelli Rondelli].—*Riv. Parassit.* 3 no. 1 pp. 83–86. Rome, 1939. [Cf. R.A.E., B 27 39.]

GIBBINS (E. G.). **Simuliidae and Onchocerciasis** [*Onchocerca volvulus*] in Uganda [a summary of present knowledge].—*E. Afr. med. J.* 15 no. 11 pp. 378–384, 19 refs. Nairobi, 1939.

REICHENOW (E.). **Ueber die Entwicklungsfähigkeit der Kulturformen von *Trypanosoma gambiense* und *T. congolense* in Glossinen.** [On the Capacity for Development of Culture Forms of *T. gambiense* and *T. congolense* in *Glossina* Flies (*G. morsitans*, Westw.)].—*Arch. Schiffs- u. Tropenhyg.* 43 pt. 5 pp. 197–202, 7 refs. Leipzig, 1939.

SCHMIDT (G.). **Gebräuchliche Namen von Schadinsekten in verschiedenen Ländern.** [Common Names of Insect Pests (including mites and ticks) in various Countries].—*Ent. Beih. Berl.* 6 160 pp. Berlin, 1939. [Cf. R.A.E., A 27 437.]

BROOM (J. C.). **The Maintenance of *Glossina morsitans* in England for Experimental Work.**—*Trans. R. Soc. trop. Med. Hyg.* **32** no. 5 pp. 633–638, 5 refs., 1 chart. London, 1939.

A method for rearing and maintaining considerable numbers of *Glossina morsitans*, Westw., for experimental work in England is described, and a table is given showing the estimated numbers surviving out of an original population of 10,000 flies at any time during the first five weeks of life after an initial feed. The data from which the table was prepared were obtained by noting the manner in which populations which totalled between 4,000 and 5,000 flies diminished in number from the time of the infecting feed until the survivors were killed for dissection five weeks later.

YOKOGAWA (Sadamu). **Studies on the Mode of Transmission of *Wuchereria bancrofti*.**—*Trans. R. Soc. trop. Med. Hyg.* **32** no. 5 pp. 653–668, 13 refs. London, 1939.

The experiments described were undertaken with a view to elucidating the mode of transmission of *Filaria (Wuchereria) bancrofti*, since the author considered that if it took place through the bite of the mosquito vector the incidence of the disease should correspond closely to the prevalence of the mosquito [but cf. *R.A.E.*, B **8** 116]. This is not, however, the case in Formosa, where the disease is rare among the natives, although the parasite is being continuously introduced and *Culex fatigans*, Wied., the most common vector, is found all over the island. However, experiments on the possibility of transmission in other ways gave negative results. The ability of the filarial larvae to invade the deeper tissues through the orifices left by the bites of mosquitos seems to depend on the property of lymphotaxis. Thus, when the exudation of lymph resulting from a mosquito bite is poor and the skin is dry, larvae set free from the proboscis of the mosquito during the act of biting remain almost inactive, whereas, when there is much lymph, the larvae follow its flow and so make their way to the lymph spaces of the deeper tissues. Observations showed that the infection rate in mosquitos in a heavily infected region was extremely low, and afforded evidence that even if infective mosquitos are given the opportunity of feeding on man, transmission cannot occur unless sufficient lymph is exuded from the bite to excite lymphotaxis in the microfilariae.

DASSANAYAKE (W. L. P.). **A preliminary Note on Filariasis in Ceylon, 1936–1937.**—*J. trop. Med. Hyg.* **41** no. 9 pp. 141–143, 4 refs. London, 1938. **A Note on Filariasis in the Southern Province, Ceylon, 1938.**—*Op. cit.* **42** no. 4 pp. 51–53, 2 refs. 1939.

These papers deal with investigations on filariasis in the North-Western and Southern Provinces of Ceylon, respectively, and include accounts of the physiography, climate and population of the two provinces and the incidence and distribution of the disease in them.

In the North-Western Province, the distribution of filariasis is very uneven; cases were observed in all of the 11 sections into which the province is divided, but 80 per cent. were in an area situated in the catchment basins of two rivers. Even within this endemic area there were small foci where cases were numerous surrounded by areas

with very similar climatic conditions where they were few or absent. Of the 4,356 blood films examined, 1,200 harboured microfilariae, all of which were those of *Filaria (Microfilaria) malayi*. The disease is mainly restricted to villages situated near reservoirs containing a heavy growth of *Pistia* or beside the two rivers mentioned. Species of *Mansonia* were found in infected villages in large numbers, and natural infections were detected in them.

In the Southern Province, the distribution of the disease is also very uneven, and although cases were observed in all of the 15 sections, more than 80 per cent. were in 8 circumscribed endemic areas, of which 7 were near reservoirs or seepage areas containing growths of *Pistia*, and the other comprised a part of the town of Galle where conditions are favourable for the breeding of *Culex fatigans*, Wied., and this mosquito was abundant. Of the 7,329 persons examined, 6·2 showed microfilariae in the peripheral blood and of these 80 per cent. were those of *F. malayi* and 20 per cent. those of *F. (Wuchereria) bancrofti*. In the areas where *F. malayi* was prevalent, species of *Mansonia*, particularly *M. uniformis*, Theo., were numerous and natural infections were detected in them. *F. bancrofti* was found chiefly in the part of Galle where *C. fatigans* was abundant.

BURR (M.). *The Insect Legion*.—Demy 8vo, xiv+321 pp., frontis., 15 pls., 5 figs., London, J. Nisbet & Co. Ltd., 1939. Price 12s. 6d.

In the first part of this book, the author gives a popular account of insect biology, and in the second, he emphasises the great importance of insects to man whether as food and medicine or as pests, particularly those that are vectors of disease. The economic importance of both harmful and beneficial insects and the control of the former are discussed, with an account of the history of entomology in ancient and modern times.

HENRY (A.) & GUILHON (J.). *Gale déplumante déterminée par Microlichus avus Tr. chez un serin*.—*C. R. Soc. Biol.* **130** no. 5 pp. 431-432. Paris, 1939.

A case is recorded of the mite, *Microlichus avus*, Trouessart, infesting a canary and causing the same symptoms as those generally attributed to *Cnemidocoptes laevis*, Railliet. Records from the literature of *M. avus* infesting various birds are given.

VAN BEUKERING (J. A.). *Filarialarve in een Anopheles ludlowi*. [A Filaria Larva in *A. sundaicus*, Rdnw.]—*Geneesk. Tijdschr. Ned. Indië* **79** pt. 18 p. 1114. Batavia, 1939.

The observation is recorded of a mobile larva of *Filaria* in the thorax of an example of *Anopheles sundaicus*, Rdnw. (*ludlowi*, auct.), dissected at Moera Siberoet, in the Mentawai islands, near Sumatra. This mosquito had been captured in a hutment lodging 86 convict labourers, and 3 of them were found to harbour microfilariae.

CAUSEY (O. R.). *Aëdes and Culex Mosquitoes as intermediate Hosts of Frog Filaria, Foleyella sp.*—*Amer. J. Hyg.* **29** (C) no. 2 pp. 79-81, 5 refs. Lancaster, Pa., 1939.

Examination of the blood of frogs from southern Florida revealed the presence of microfilariae of a species of *Foleyella* in large numbers

in most of the mature specimens of *Rana pipiens* and *R. sphenocephala*. Examples of *Aëdes aegypti*, L., and *Culex pipiens*, L., fed on these frogs became infected, and what appeared to be mature filarial larvae were observed in the thorax about 13 days after the infecting feed.

HU (S. M. K.). *Observations on the Development of Filarial Larvae during the Winter Season in Shanghai Region.—Amer. J. Hyg.* **29** (D) no. 2 pp. 67-74, 3 figs., 7 refs. Lancaster, Pa., 1939.

The observations described in this paper were made during the winter of 1935-36 to ascertain the effect of winter conditions in the Shanghai region on the development of the larvae of *Filaria (Wucheria) bancrofti* in females of *Culex pipiens* var. *pallens*, Coq. In the first series of observations, five batches of mosquitos that had been allowed to feed once between 11th and 24th December on an infected person were kept in an unheated room and exposed to natural conditions of temperature and humidity. They were not dissected until three or more weeks after the infecting feed, in order to allow time for the possible development of any filarial larvae that they might harbour. Only 20 out of 191 mosquitos became infected, and the larvae in these were all dead; they appeared not to have developed after penetrating into the haemocoel of the mosquito.

In order to determine how long the first-stage filarial larvae are able to survive in the mosquito, a batch of females was fed once on an infected person on 6th February, placed under the same conditions as the previous ones, and dissected at intervals of up to 28 days after the infecting feed. Of 88 mosquitos 74 became infected. The last living microfilaria in the stomach was seen on the 15th day. Filarial larvae were seen in the thorax of only three mosquitos, one living one on the 8th day and two dead ones on the 15th and 17th days, respectively. Since under natural conditions, females of *C. pipiens* var. *pallens* usually take their last blood meal of the year at the beginning of winter and then hibernate, a further series of experiments was undertaken to ascertain whether infective filarial larvae are able to survive the winter in them. Batches of females were fed between 22nd and 29th November, kept in the unheated room, and dissected at intervals up to 7th April. Of 44 mosquitos 35 contained larvae, and 31 infective larvae, at the time of dissection. In all but two mosquitos examined up to 11 weeks after the infecting meal all the infective larvae were alive; some living infective larvae were found on 13th March (16th week), but all those found after this time were dead. In a further experiment, part of a batch of mosquitos fed on 6th December and kept in a slightly heated room (average mean temperature 54·4°F.) were transferred on 15th January to the unheated room. In this lot, the last living infective larvae were seen on 3rd February (59th day), whereas living infective larvae were found on 10th March (95th day) in mosquitos retained in the heated room. It thus appears that under natural conditions, the infective larvae might be able to survive longer in mosquitos in less exposed hibernation quarters. In the Shanghai region, *C. pipiens* var. *pallens* emerges from hibernation towards the end of March, so that some mosquitos infected before the winter might still be infected in the following spring.

Hu (S. M. K.). Preliminary Observations on the Effects of Filarial Infection on *Culex pipiens* var. *pallens* Coq.—*Chin. med. J.* 55 no. 2 pp. 154-161, 4 refs. Peking, 1939.

The two experiments described were undertaken in 1934 and 1937, respectively, to determine whether infection with *Filaria (Wuchereria) bancrofti* affects the longevity of females of *Culex pipiens* var. *pallens*, Coq. The technique in both experiments was the same. The females were reared from a single lot of larvae, and only those that emerged on the same day were used. They were allowed access to raisins for two days and then starved for one day before being given their blood meal; one half of the mosquitoes in each experiment was then fed for one hour in the evening (9-10 p.m.) on an infected person and the other half on an uninfected one. Females that engorged were kept in breeding chambers with access to raisins and water. In 1934, the mosquitos were given their blood meal on 10th January and were kept in a heated room to prevent the cold weather from affecting the development of the filarial larvae; in 1937, they were fed on 10th May and as they were kept in an unheated room, they survived for a longer period than those in the first experiment. The dead females from the lots that had had an infecting feed were collected daily and examined for filarial larvae, and records were kept of the numbers dead in the control lots. The incubation period of the filarial larvae was about 14 days in the first experiment and between 15 and 20 in the second. In the lots that had had an infecting feed, only 5 out of 56 individuals in the first experiment and 4 out of 144 in the second died before the completion of the respective incubation periods of the filarial larvae. In the corresponding control lots, 4 out of 31 and 2 out of 113 died within these periods. The data so far obtained indicate that the mosquitos that were able to survive longest were generally those that contained few or no filarial larvae. However, those that succumbed soon after the completion of the incubation periods included many lightly infected examples as well as heavily infected ones.

[LAZUK (A. D.) & UTENKOV (I. N.).] Пазук (А. Д.) и Утенков (И. Н.). La mise à sec des étangs à moulin comme moyen de lutte anti-larvaire. [In Russian.]—*Med. Parasitol.* 7 no. 6 pp. 847-859, 1 fig. Moscow, 1938. (With a Summary in French.)

An experiment on the control of Anopheline larvae by draining was carried out in July 1936 in a mill-pond in the southern part of the Western Province of European Russia [cf. *R.A.E.*, B 26 46], where favourable breeding places for mosquitos are provided by numerous rivers, streams, lakes and other accumulations of water. Cases of malaria were two or three times as numerous in villages close to the ponds as in those some distance from them. In the experiment described, the mill-pond was drained slowly, the process taking 8 hours, and kept empty for 4 days; most of the larvae remained in the mud and weeds, and very few were carried away by the drainage. Most of those that remained died, especially the younger ones, and some of the aquatic vegetation was killed. The bottom of the pond dried very irregularly, owing to the nature of its surface and the distribution of vegetation. A hard crust was formed on the second day in elevated parts free from vegetation, but in depressions, especially those in which plants were present, the process of drying took 3 or 4 days. After the pond had been refilled, a few larvae were observed near the edges; these had

probably survived in small pools of water on the bottom, which indicates that the period during which the pond is kept empty should be increased to 5–6 days. Temporary drainage ditches should also be dug in the bottom, or the pools of water that remain should be treated with a larvicide.

[PRENDFL' (A. R.) & SOMOV (A. A.).] Прендель (А. Р.) и Сомов (А. А.). On the epidemiological Importance of the Subspecies of *Anopheles maculipennis*. [In Russian].—*Med. Parasitol.* 7 no. 6 pp. 860–873, 2 diagrs., 4 graphs, 19 refs. Moscow, 1938. (With a Summary in English.)

The examination in the summer and autumn of 1937 of over 3,000 batches of eggs deposited by females of *Anopheles maculipennis*, Mg., taken in and near human dwellings and cow-sheds in 5 districts in the Province of Odessa showed that race *messeae*, Flni., predominated in all of them except Odessa itself, in which race *atroparvus*, van Thiel, was the most numerous, while race *maculipennis (typicus)* was scarce [cf. *R.A.E.*, B 26 219]. Adults of race *messeae* were most abundant in day-time shelters in June and July, and of race *atroparvus* in July and again in September; in districts in which they occurred together, adults were most numerous in June–July and there was a small rise in September. Both *messeae* and *atroparvus* showed a decided preference for animal quarters; thus, the numbers of mosquitos taken at each inspection in 2 malarious districts averaged 8·7 and 25·4 for dwellings and 518·2 and 1,201·3 for cow-sheds, the corresponding averages for a moderately malarious district being 2·06 and 91·2, and for a non-malarious one 0·8 and 67·2. In districts in which *atroparvus* predominated, the adults were particularly abundant in cow-sheds in April–May and again in September, when they constituted 93·3 and 96·5 per cent., respectively, of the Anophelines taken. They hibernated in the cow-sheds. Some females showed gonotrophic dissociation as early as the end of September, although others continued to oviposit in the second half of October, and in the environs of Odessa engorged females were found in cow-sheds as late as 22nd December. Adults of race *messeae* comprised 55·9 per cent. of the Anophelines taken in cow-sheds in July–August, but they congregated in cellars from the second half of September. There was a constant interchange of Anopheline population between the dwellings and cow-sheds, as precipitin tests showed that of the females taken in dwellings 19·2–19·8 per cent. contained human blood and 80·2–80·8 per cent. that of cattle, the corresponding percentages for those taken in cow-sheds being 3·4–9 and 91–95·6.

It is concluded from these observations that in southern Ukraine both *messeae* and *atroparvus* are potentially equally important vectors of malaria, whereas *maculipennis (typicus)* is of no importance.

[DANILOVA (M. I.) & BUDUIMKO (F. A.).] Данилова (М. И.) и Будымко (Ф. А.). Les espèces de l'*Anopheles* et leur rôle épidémiologique dans la région d'Adyguée (Caucase du Nord). [In Russian].—*Med. Parasitol.* 7 no. 6 pp. 874–877. Moscow, 1938.

The Anophelines observed in the autonomous Province of Adygheï, in the western part of the northern Caucasus, were *Anopheles maculipennis*,

Mg. (represented by races *maculipennis* (*typicus*), *messeae*, Flni., and *atroparvus*, van Thiel), *A. hyrcanus*, Pall., *A. claviger*, Mg. (*bifurcatus*, auct.), and *A. plumbeus*, Steph. *A. plumbeus* occurred only in forests, but since it readily feeds on man [cf. R.A.E., B 27 73] and considerable numbers of men work in the forests, it may be of importance in the spread of malaria. *A. claviger*, the larvae of which bred in accumulations of water fed by springs, seldom entered inhabited houses and animal quarters and attacked man only in the open. *A. hyrcanus* occurred in the second half of the summer in dwellings and animal quarters situated near swamps overgrown with reeds [cf. 27 71]. *A. m. atroparvus* was scarce. *A. m. messeae* and *A. m. maculipennis* were widely distributed, the former predominating in the low-lying marshy plain and the latter in the hilly area at the foot of the mountains. Anopheline larvae, principally those of *A. maculipennis*, were abundant in rivers, streams, lakes, swamps, accumulations of water in old river beds and ponds near villages. The adults occurred in houses and especially in animal quarters situated in the vicinity of the breeding places. Of the females taken in houses, 75 per cent. were engorged and 24.24 per cent. contained mature eggs. Precipitin tests confirmed the observation that females of *A. maculipennis* usually shelter in the place in which they have fed [cf. 25 113]. Thus, of the females taken in cow-sheds, up to 70 per cent. contained the blood of cattle, 11 per cent. that of other animals and birds, and 19 per cent. had fed on man. In empty buildings, 42 per cent. of the mosquitos contained blood of cattle and 31.5 per cent. that of man. Races *maculipennis* and *messeae* appear to be the chief vectors of malaria in the Province, especially in the low-lying marshy plain, where the incidence of malaria was highest, the parasite index there ranging from 6.2 to 10, as compared with 2.6-7.6 elsewhere.

[KALANDADZE (L. P.) & SAGATELOVA (I. S.).] **Каландадзе (Л. П.) и Сагателова (И. С.).** Matériaux concernant la distribution des sous-espèces de l'*Anopheles maculipennis* en Géorgie. [In Russian.]—*Med. Parasitol.* 7 no. 6 pp. 878-880, 3 refs. Moscow, 1938. (With a Summary in French.)

The examination in 1935-1938 of 2,459 batches of eggs laid in captivity by females of *Anopheles maculipennis*, Mg., taken in various districts in Georgia revealed the presence of races *maculipennis* (*typicus*), which was the most abundant, occurred everywhere and was the only race present in the mountains [cf. R.A.E., B 26 239]; *sacharovi*, Favr, which occurred in only a few districts in the plains of eastern Georgia; and a race of the group *messeae*, Flni., which was found in two low-lying localities in eastern and western Georgia (Poti and Kakhetiya); the intercostal membrane of the eggs of this form differed somewhat from that of the northern *messeae*, and was similar to that of *A. m. subalpinus*, Hackett & Lewis. Among the eggs of the typical race occurred the form with small floats described by Barber and Hackett [cf. 23 288]. Details are given of the local distribution of the races of *A. maculipennis*, the dates of the capture of the females, the shelters in which they were taken, and the numbers of egg batches deposited by them.

[KESHISH'YAN (M. N.)] **Кешишьян (М. Н.).** *Anopheles lindesayi* Giles en Tadzhikistan (exemplaires ailés). [In Russian.]—*Med. Parasitol.* 7 no. 6 pp. 881–887, 4 figs. Moscow, 1938.

Further collections of the larvae and pupae of *Anopheles lindesayi*, Giles, were made in 1938 in passes on the southern slope of the Hissar mountains in western Tadzhikistan [cf. *R.A.E.*, B 27 69] and about 300 adults were bred from them in the laboratory in Stalinabad. Detailed descriptions are given of the morphology of the adults of both sexes, together with notes on the distinguishing characters of the varieties *nilgiricus*, Chr., *cameronensis*, Edw., *japonicus*, Yam., *benguetensis*, King, and *pleccau*, Koidz., which the author regards as being also a distinct variety [but cf. 20 217]. The morphological characters of the pupa of *A. lindesayi* are shown in a figure.

[KESHISH'YAN (M. N.)] **Кешишьян (М. Н.).** A new Species of the Anopheles Mosquito *A. sogdianus* sp. nov. in Tadzhikistan. [In Russian.]—*Med. Parasitol.* 7 no. 6 pp. 888–896, 5 figs., 3 refs. Moscow, 1938. (With a Summary in English.)

Detailed descriptions are given of the adults of both sexes of *Anopheles sogdianus*, sp. n., reared in the laboratory from a large number of larvae and pupae collected at an altitude of over 3,280 ft. in clear shaded water in streams and springs in the mountains of western Tadzhikistan. The larva and pupa are provisionally described, and characters are given distinguishing the adults and larva of the new species from those of the North African *A. marteri*, Sen. & Prun., which closely resembles it, and from several European and Asiatic species.

[MARKOVICH (N. Ya.)] **Маркович (Н. Я.).** Maturation des œufs chez *P.A. bifurcatus* sans alimentation. [In Russian.]—*Med. Parasitol.* 7 no. 6 p. 898. Moscow, 1938.

Laboratory observations on the females of *Anopheles claviger*, Mg. (*bifurcatus*, auct.) in North Caucasus showed that the development of the ovaries proceeds even in the absence of food. The majority of the newly emerged females possessed ovaries that had reached stage II of Christophers [cf. *R.A.E.*, B 25 37], and at a mean temperature of 20–22°C. [68–71·6°F.] stage V was reached in 65–70 hours without any meal of blood or sugar solution. Females with mature eggs oviposited after feeding on a solution of sugar, and in some instances the ovaries developed again up to stage III. Oviposition was not repeated, however, without a blood meal.

Similar results were obtained in Georgia by Kalandadze.

[SHCHURENKOVA (A. I.) & DOLMATOVA (A. V.)] **Шуренкова (А. И.) и Долматова (А. В.).** Technique perfectionnée de la coloration des femelles du *Phlebotomus* pour la détermination des espèces. [In Russian.]—*Med. Parasitol.* 7 no. 6 pp. 929–931. Moscow, 1938. (With a Summary in French.)

A method of preparing specimens of females of *Phlebotomus* is described by which the structure of the spermatheca and pharynx is made very clear. The insects are immersed for 16–19 hours at 60°C. [140°F.] in a mixture of 5 parts formic acid (or concentrated glacial

acetic acid) and one part of a 20 per cent. solution of pyrogallic acid. The latter should be at least 24 hours old, to obtain satisfactory coloration. Instructions are also given for the preparation of specimens of *Phlebotomus* in Canada balsam.

[VINOGRADSKAYA (O. N.) & TIMROT (S. D.).] **Виноградская (О. Н.) и Тимрот (С. Д.).** *Culture de l'A. superpictus Grassi au laboratoire.* [In Russian.]—*Med. Parasitol.* 7 no. 6 pp. 940-941. Moscow, 1938.

Details are given of the breeding in the laboratory in Moscow of *Anopheles superpictus*, Grassi, from females taken in Stalinabad (Tadzhikistan) in October 1937. Till about the end of November, the adults and larvae were kept at a temperature of 26-27°C. [78·8-80·6°F.] and from then onward at 29-31°C. [84·2-87·8°F.] and a relative humidity of 40-50 per cent. It was found that in the laboratory, the behaviour and physiological condition of the mosquitos considerably differed from those observed in the field. In all generations, of which 5 were produced up to about the end of May of the following year, the females took blood several times before ovipositing, whereas in nature, as a rule, one blood meal is sufficient for the maturation of eggs. The majority of the initial females were in a state of gonotrophic dissociation ; although they repeatedly fed on blood, their ovaries did not develop and most of them produced fat-body. A few, however, oviposited and the resulting adults emerged between 9th and 27th November. Practically all the females of this generation also produced fat-body only, in spite of repeated feeding. Only 2 of them oviposited, in the second half of December. The adults of the second laboratory generation emerged between 6th and 14th January, and the first batch of eggs was deposited on 28th January.

[SAVITZKIĭ (V. I.).] **Савицкий (В. И.).** *Ponte hivernale du Culex pipiens L.* [In Russian.]—*Med. Parasitol.* 7 no. 6 pp. 942-943. Moscow, 1938.

An instance is recorded of the breeding of *Culex pipiens*, L., in February 1937 in the building of a large public swimming bath in Kiev. The adults, about 50 per cent. of which were males, were very numerous and caused considerable annoyance. Larvae of all instars and pupae were abundant in a gully round the bath and in water containers near the refreshment room, the temperature of the water being 20-21°C. [68-69·8°F.] and that of the air about 23°C. [73·4°F.].

MULLIGAN (H. W.) & AFRIDI (M. K.). **The Prevention of Malaria incidental to Engineering Construction.**—*Hlth Bull.* no. 25 (*Malar. Bur.* no. 12) ii+52 pp., 4 pls., 11 figs. (6 fldg), 3 refs. Dehli, Manager of Publications, 1938. Price 8d.

The object of this bulletin is to indicate the way in which the incidence of malaria in India has increased in the past as a result of construction works of various kinds and to outline the precautions that should be taken to prevent this continuing in the future. In the introduction, it is pointed out that it is usually far less expensive in the long run to avoid the formation of Anopheline breeding places than to eliminate them after they have been formed, and that this is possible only when health authorities and engineering services co-operate. In the second

section, some of the basic facts with respect to the transmission of malaria and other diseases by mosquitos are briefly discussed. The third section deals with such general considerations as the formulation of contracts for engineering projects so that conditions inducing increased malaria transmission shall be avoided, the prevention of the malaria that may accompany the presence of large labour forces and the clearing of jungle, and the elimination of breeding places formed by excavation and by the construction of embankments, roads, railways, dams and barrages. The fourth section deals in particular with the relation of malarial incidence to different types of irrigation, including perennial irrigation and irrigation by means of inundation, wells and piped water [cf. R.A.E., B 27 152], and with related subjects, such as the advisability of abolishing wet cultivation and canal irrigation in populous areas, the necessity for providing sufficient bridges over irrigation channels and for protecting the banks of the latter from damage by cattle, etc. The fifth section deals with the prevention of malaria during the building of towns, dwellings, etc., and includes notes on the selection of healthy sites and their preparation for building, the provision of water supplies, precautions to be adopted in the construction of houses so that the formation of breeding places is avoided, the mosquito-proofing of houses, and the provision of storm-water drains and of systems of sullage and sewage disposal. The "principles to be observed in the preparation of canal projects and in their execution," recommended in the Proceedings of the Water-Logging Board, Punjab, in December 1930, are reproduced in an appendix.

ROCHA (F.). **Malaria Control at "Mina de S. Domingos."**—*Arq. Inst. bact. Cam. Pest.* 6 fasc. 2 pp. 123–137, 2 maps, 2 graphs, 17 refs. Lisbon, 1930, *op. cit.* 7 fasc. 3 pp. 363–374, 2 graphs, 1938.
(With Summaries in French and German.)

In the first paper, an account is given of local conditions at and round the copper pyrites mine of S. Domingos, in the Province of Alemtejo, Portugal, where the author carried out an investigation in 1925–26. Malaria, which was the predominant disease there in the nineteenth century, then greatly decreased in incidence, the percentage of cases in the months of highest incidence falling from 22 in 1877 to 0·8 in 1925, and deaths were no longer caused by it. The causes that contributed to this result include the construction of reservoirs which were kept stocked with fish, by damming the waters of streams, thus eliminating many pools that provided breeding places for Anophelines, the drainage of mineral liquors from the mine into the Chumbeiro stream, and, since 1921, oiling twice weekly any existing pools. The Anophelines observed by the author were *Anopheles maculipennis*, Mg., which was the more numerous, and *A. claviger*, Mg. (*bifurcatus*, auct.).

The second paper comprises a report for the further ten years 1927–36. The percentage of malaria infections rose steadily until it reached about 3·1 in the month of highest incidence in 1932, after which it decreased continuously, falling to 0·5 in that of 1936. This low incidence of the disease is expected to continue, provided that there is no relaxation of control measures, particularly against Anopheline breeding. Those adopted comprise oiling, dusting with Paris green and clearing of vegetation from the edges of dams. The use of *Gambusia* was planned for 1938.

TARWID (K.). Notatki faunistyczne o muchówkach Polski. I. Zestawienie dotyckiezasowych wiadomości o faunie komarów Polski. [Notes on the Dipterous Fauna of Poland. I. Compilation of present Knowledge on the Mosquito Fauna of Poland.]—*Fragm. faun. Mus. zool. polon.* 3 no. 26 pp. 503–510, 18 refs. Warsaw, 1938. (With a Summary in German.)

A list is given of the mosquitos that have been recorded from Poland, with notes on their synonymy and distribution. The species of *Anopheles* recorded are *A. claviger*, Mg., and *A. maculipennis*, Mg. [cf. *R.A.E.*, B 22 216]. The question of races of the latter has not so far been studied in Poland, but the author considers, on the basis of notes by Dr. H. Raabe, that the races occurring there are *maculipennis (typicus)*, *messeae*, Flni., and a race approaching *atroparvus*, van Thiel, but differing somewhat from it.

WEYER (F.) & BOCK (E.). Versuche zur Uebertragung verschiedener Plasmodien-Arten auf Anophelen. [Experiments on the Transmission of various Species of *Plasmodium* to *Anopheles*.]—*Arch. Schiffs- u. Tropenhyg.* 43 pt. 6 pp. 256–266, 6 refs. Leipzig, 1939.

These experiments in Hamburg were carried out with females of *Anopheles maculipennis*, Mg., race *atroparvus*, van Thiel, from a strain maintained in Hamburg for about 3 years; race *labranchiae*, Flni., bred from eggs received from Italy; and *A. superpictus*, Grassi, bred from eggs from Albania. They engorged in 5–10 minutes when allowed access to gametocyte carriers and were then placed in cages at an average temperature of 24–25°C. [75·2–77°F.]. Sugar-water was provided, and most of the mosquitos had opportunities during the first 12 days of feeding once or twice on a rabbit or guineapig.

The results of the experiments are tabulated and discussed, and are summarised as follows: Successful infection of the mosquitos depends mainly on the number of mature gametocytes. All experiments in which the male gametocytes flagellated gave positive results, and all those in which they did not were negative. The biological capacity for forming microgametes appears to be lost to some extent in the course of repeated passages through man. *A. maculipennis* proved more suitable for infection with *Plasmodium vivax* than with *P. falciparum*, infection with which succeeded best with *A. superpictus*.

Dissection of 172 females of *A. maculipennis*, mostly belonging to race *atroparvus*, that had fed once on carriers of gametocytes of *P. vivax* showed that of these, 102 contained sporozoites or oöcysts, corresponding to an experimental infection index of 59·3 per cent. In individual experiments, this index sometimes reached 100 per cent. An infection index of 81 per cent. was observed in 21 females of *A. superpictus* fed on carriers of *P. falciparum*. Increased mortality occurred in some experiments in which the mosquitos were especially strongly infected; this may possibly have been connected with the infection.

Attempts to infect females of *A. maculipennis* and *A. superpictus* with *P. ovale* were mostly negative, owing chiefly to the small numbers of mature gametocytes. A low rate of gametocyte production appears to be a biological peculiarity of this species of *Plasmodium*. In all, 291 females were fed on carriers of *P. ovale*, and of these, 216 were

dissected. A semi-mature oöcyst was found in one example of *A. maculipennis*, and sporozoites were observed in the salivary gland of another.

BONNE-WEPSTER (J.) & BRUG (S. L.). **Observations on the Breeding Habits of the Subgenus *Mansonioides* (Genus *Mansonia*, Culicidae).**—*Tijdschr. Ent.* **82** pt. 1-2 pp. 81-90, 18 refs. Amsterdam, 1939.

The following is based on the authors' summary of observations on the breeding habits of mosquitos of the subgenus *Mansonioides* of *Mansonia* carried out in Batavia and in a swamp of the Serajoe Delta, Java: The larvae and pupae are often difficult to detect, and a search for the eggs is sometimes more successful. Eggs, larvae and pupae may be found on water plants other than *Pistia* [cf. R.A.E., B **25** 195; **26** 72], even in breeding places well stocked with this weed. *Mansonia (Mansonioides) uniformis*, Theo., used a considerable number of water plants, lists of which are given, as hosts either for its eggs or for its larvae and pupae. If only *Pistia* is present, the majority of the larvae sometimes occur not on its roots, but in the water or mud at the bottom. Some evidence was obtained that oviposition and hatching in *M. (M.) annulifera*, Theo., occur periodically.

BONNE-WEPSTER (J.). **Notes on Mosquitoes from the Netherlands Indies. Two new *Mansonia* Larvae from Borneo.**—*Meded. Dienst. Volksgezondh.* **28** no. 1 pp. 11-13, 2 pls., 3 refs. Batavia, 1939.

In August 1937, the author received from the interior of Borneo 3 females of *Mansonia annulata*, Leic., and 4 of *M. longipalpis*, Wulp, from a Dyak village in which the population was infected with *Filaria (Microfilaria) malayi*. A few weeks later, he received another 12 females, all taken on man, comprising 2 of *M. longipalpis*, 6 of *M. indiana*, Edw., and 4 of *M. crassipes*, Wulp. Several larvae were subsequently collected there in a small lake near the roots of a common vegetable, *Ipomoea* sp.; the lake was usually covered with *Eichhornia crassipes*, but the larvae were not observed near the roots of this plant. A series of *M. longipalpis* and *M. crassipes* were bred from larvae in test tubes, with *Ipomoea* as the host plant; the larvae of these species are described.

ZUMPT (F.). **Die Wundheilung mittels Fliegenmaden ein gelöstes Problem.** [The Healing of Wounds by Fly Maggots is now a solved Problem.]—*Z. Reichsfachschaft Krankenpfleger* **6** pt. 8 pp. 1-3, 2 figs. Osterwieck/Harz, 1938.

Notes are given on the habits of flies that are attracted to putrefying flesh, together with a short historical account of the use of blowfly larvae, chiefly those of *Lucilia sericata*, Mg., in the treatment of wounds and osteomyelitis [cf. R.A.E., B **20** 125-129; **21** 174, etc.]. The healing of wounds proceeds through the excretion by the maggots of allantoin [**23** 305], which contains urea [**25** 159], synthetic preparations of which are now being used instead of maggots.

ZUMPT (F.). **Das Tsetseproblem im britischen Mandatsgebiet Tanganyika.** [The Tsetse Problem in Tanganyika.]—*Umschau* 1939 pt. 18 repr. 4 pp., 4 figs. Frankfurt a. M., 1939.

A general account is given of conditions with respect to sleeping sickness and trypanosomiasis of domestic animals in Tanganyika, not less than two-thirds of which is infested with tsetse flies. Of the 20 species known from Africa, 8 occur in Tanganyika [cf. *R.A.E.*, B 25 161]. As vectors of trypanosomiasis of man and animals, *Glossina swynnertoni*, Aust., and *G. morsitans*, Westw., are the most important. These two and *G. pallidipes*, Aust., occur in the savannahs. This last is also an important vector of animal trypanosomiasis, but its preference for game and domestic animals makes it usually harmless to man. All three live in regions that are completely arid in the dry season and are therefore independent of open surfaces of water, only needing a little shade in which to deposit their larvae and find suitable resting places. *G. palpalis*, R.-D., which attacks man, is confined to the damp forests on the banks of Lakes Victoria and Tanganyika. The comparatively few cases of sleeping sickness that occur (293 fresh cases in a population of about 5 million were reported in 1937) are due to *G. morsitans* and *G. swynnertoni*. The usual measures against these flies are discussed.

GHIDINI (G. M.). **Di alcuni Ditteri ematofagi della Regione dei Laghi (A.O.I.).** [Some Blood-sucking Diptera of the Lake Region in Abyssinia.]—*Boll. Soc. ent. ital.* 71 no. 2 pp. 40–44, 2 figs. Genoa, 1939.

Descriptions are given of several blood-sucking Diptera taken in the region of the lakes in Galla Sidama, Abyssinia; they include 6 Tabanids and *Glossina longipennis*, Corti, which had been regarded as occurring mostly in drier areas.

OSWALD (B.). **O nalazu babesida u jajima iksodida.** [Piroplasms in Eggs of Ixodids.]—*Vet. Arhiv* 9 no. 5 pp. 304–306, 2 figs., 6 refs. Zagreb, 1939. (With a Summary in English.)

Pear-shaped forms of *Piroplasma (Babesia) bovis* were repeatedly observed in May 1938 in smears from eggs laid in the laboratory in northern Jugoslavia by an engorged female of *Ixodes ricinus*, L., taken from an ox infected with piroplasmosis.

BILAL (S.). **Essais de transmission de la tularémie aux tortues terrestres.**—*Bull. Soc. Path. exot.* 32 no. 2 pp. 141–143. Paris, 1939.

In the experiments described, land tortoises inoculated with a strain of *Bacterium tularensis* isolated in Thrace during 1936 became infected. The disease remained latent in the adults, but a young one was killed by it. About 20 examples of the tick, *Hyalomma aegyptium*, L., were found on the tortoises, and the disease was transmitted to guineapigs by injecting into them suspensions of adult ticks of both sexes that had fed on infected tortoises.

HERMS (W. B.). **Medical Entomology, with special reference to the Health and Well-being of Man and Animals.**—Med. 8vo, 3rd revd. edn., xix+582 pp., 196 figs. New York, The MacMillan Co., 1939. Price £1 4s. 0d.

Although the title of this book has been altered, it is the third edition of the one previously known as Medical and Veterinary Entomology [cf. R.A.E., B 4 176; 13 119]. The recent rapid advances in the knowledge of the transmission of diseases by Arthropods has necessitated the complete revision of the work; much of the material has been re-written and re-arranged, and a considerable amount of new matter has been incorporated. Numerous new illustrations have been used to replace old ones, and bibliographies, which are now appended to almost every chapter, contain many new references.

The importance of the experimental method and of the study of the ecology of Arthropods in investigations on the transmission of disease is emphasised. In the chapter, How Insects and Arachnids cause and carry Disease, the ways in which injury is caused are dealt with more fully, and sections on hereditary transmission of the causal organisms of disease in Arthropods and on Arthropods as intermediate hosts of helminths have been added. Information on Arachnids has been appended to the chapters on structure, development and classification. Considerably more information is given on the relation of Triatomids to the transmission of *Trypanosoma cruzi*, and keys to some predacious Reduviids that are likely to be of medical importance, to the principal families of Heteroptera of North America that contain predacious species, and to the North American Cicinids have been added. The chapters on Diptera begin with a section on their general characteristics and classification and a key to some of the families, and include sections on the relation of Simuliids to the transmission of onchocercosis to man and of species of *Leucocytozoön* to poultry, of species of *Phlebotomus* to the transmission of verruga, sandfly fever, and dermal and visceral leishmaniasis, of Ceratopogonids to the transmission of filariasis, and of Chloropids to the transmission of conjunctivitis and yaws. Mosquitos are discussed in their relation to the transmission of jungle yellow fever, malaria of birds, equine encephalomyelitis and fowl pox, and their control is dealt with more comprehensively. In the chapter on house-flies, the notes on species other than *Musca domestica*, L., have been expanded. Much new information has been included on myiasis and the flies concerned in its causation. The section on the treatment of cattle infested with larvae of *Hypoderma* has been enlarged, as well as that on Hippoboscids infesting birds. The chapter on fleas contains additional sections on sylvatic plague, the fleas of wild rodents, fleas in connection with the transmission of endemic typhus, methyl bromide as a fumigant for the control of rodents and their fleas, rat-fleas on ships and at seaports, fleas as household pests, and fleas as intermediate hosts of cestodes. The chapter on ticks and tick-borne diseases is considerably enlarged; in the section on Rocky Mountain spotted fever, information is given on vectors other than *Dermacentor andersoni*, Stiles, and on the mechanism of infection, mention is made of Colorado tick fever and of the transmission of tularemia by ticks, and sections are inserted on the tick-transmitted relapsing fever of the United States and its vectors, the bionomics and control of *Ornithodoros hermsi*,

Wheeler, the vector in California, and the spirochaetes of relapsing fever in general. The chapter on mites includes a section on *Liponyssus bacoti*, Hirst; and much additional information on *Latrodectus mactans*, F., is given in the chapter on venomous Arthropods.

Report of the Puerto Rico Experiment Station, 1937.—115 pp., 28 figs., 6 refs. Washington, D.C., 1938.

On 15th October, 16 adults of *Copris incertus* var. *prociduus*, Say, were received in Porto Rico from Hawaii. On 27th October, 276 balls of dung containing larvae and pupae reared from these beetles were buried 6 inches deep at the edges of a pasture, and 38 adult beetles were liberated at the same time and place, for the control of the hornfly, *Lyperosia (Haematobia) irritans*, L. A batch of 33 adults of *Spalangia philippinensis*, Fullaway, a Pteromalid parasite of the same pest, was received on 4th January, also from Hawaii. A previous batch had been received in August and rearing had already been begun. A total of 7,818 adults of this parasite emerged from the 23,046 puparia of *Musca domestica*, L., 2,565 of *Anastrepha* spp., 1,500 of *L. irritans* and 1,151 of *Sarcophagula* sp. that were exposed to parasitism, and 6,812 adult parasites were liberated in 11 sections of the island. A native Pteromalid, *Spalangia muscidarum*, Rich., is of importance in the control of *L. irritans*, parasitism by it being as high as 30 per cent.; it is also of value against *M. domestica*. An apparently undescribed Diapriid of the genus *Ashmeadopria* parasitised 10 per cent. of the puparia of *M. domestica* in some collections; they were also parasitised to a small extent by *Pachycrepoideus dubius*, Ashm. One example of *S. drosophilae*, Ashm., was reared from puparia of *L. irritans* collected at Lake Guanica.

Pheidole fallax jelskii var. *antillensis*, Forel, which is one of the most common ants in Porto Rico, has been found to harbour in its abdomen the cysticercoids of one of the tapeworms of the *Raillietina* group that infests fowls. From 33 to 50 per cent. of the ants in some of the nests in barnyards and near fowl yards were found to be infested; the number of cysts in one ant varied from 1 to 8 or more.

MACLEOD (J.). The Seasonal and Annual Incidence of the Sheep Tick, *Ixodes ricinus*, in Britain.—Bull. ent. Res. 30 pt. 1 pp. 103–118, 12 graphs, 12 refs. London, 1939.

The following is substantially the author's summary: Serial examinations of the degree of infestation with *Ixodes ricinus*, L., of 35 flocks of sheep in Argyllshire, Perthshire, Selkirkshire and Northumberland during the period 1930–1938 showed that tick incidence is greatest in spring and decreases markedly in early summer. Evidence is given of a similar periodicity in North Wales. There is apparently a slight recrudescence of activity in autumn and an almost complete absence of activity in winter. The spring curve of activity terminated in early May in Argyllshire, in the middle of May in Perthshire, and towards the end of May in the Borders and Northumberland. The estimation of the relative annual infestation (e.g., in relation to the question of spread or increase of ticks) by single annual counts was found to be quite unreliable. No evidence was obtained of an increase in density of ticks in any area during the period of observation. The seasonal periodicity in activity was found to bear no relation to the density of stocking of the ground by sheep. The seasonal activity

of ticks in Argyllshire, Perthshire, Selkirkshire and Northumberland was found to be related to the air temperature, expressed as the weekly average of maximum temperatures. The limits of the air-temperature range corresponding to active tick infestation are 45°F. and 60°F. (average weekly maxima). The curve of tick infestation during 1937 on a moor in north-eastern Scotland was found to differ markedly from the normal, and the possible explanations of the discrepancy are discussed.

LEESON (H. S.). **Keys to the known Larvae and Adults of West African Anopheline Mosquitoes.**—*Bull. ent. Res.* **30** pt. 1 pp. 129–161, 36 figs. London, 1939.

Keys are given to the adults (based mainly on the females) and, with two exceptions, to the fourth-instar larvae of the species of *Anopheles* that have been recorded as occurring in West Africa from south of the Sahara to the equator. These are followed by abbreviated descriptions, diagrammatic illustrations, and very brief notes on varieties, the abundance of adults, their incidence in houses, their relation to disease, and the breeding places of the larvae.

PAPERS NOTICED BY TITLE ONLY.

MELLANBY (K.). **Fertilization and Egg Production in the Bed-bug, *Cimex lectularius* L.**—*Parasitology* **31** no. 2 pp. 193–199, 7 refs. London, July 1939.

MELLANBY (K.). **The Physiology and Activity of the Bed-Bug (*Cimex lectularius* L.) in a Natural Infestation.**—*Parasitology* **31** no. 2 pp. 200–211, 3 figs., 10 refs. London, July 1939.

ROBINSON (G. G.). **The Mouthparts and their Function in the Female Mosquito, *Anopheles maculipennis*.**—*Parasitology* **31** no. 2 pp. 212–242, 9 figs., 33 refs. London, July 1939.

MACAN (T. T.). **The Culicidae of the Cambridge District.**—*Parasitology* **31** no. 2 pp. 263–269, 8 refs. London, July 1939.

BRUG (S. L.). **Notes on Dutch East-Indian Mosquitoes [including new species].**—*Tijdschr. Ent.* **82** pt. 1–2 pp. 91–113, 11 figs. Amsterdam, 1939.

RUSSELL (Sir A. J. H.). **The Yellow Fever Position [with particular reference to the transport of the disease from Africa to India by aircraft].**—*Indian med. Gaz.* **74** no. 3 pp. 164–167. Calcutta, 1939.

BELLAMY (R. E.). **An Anopheline from inland Georgia resembling the brackish-water Race of *Anopheles crucians*.**—*J. Parasit.* **25** no. 2 p. 186. Lancaster, Pa., 1939.

CORSON (J. F.). **A final Note on a Strain of *Trypanosoma gambiense* transmitted through Monkeys by *Glossina morsitans*.**—*Ann. trop. Med. Parasit.* **33** no. 1 pp. 91–93, 4 refs. Liverpool, 1939. [Cf. R.A.E., B **27** 65.]

BENNET (B. L.), BAKER (F. C.) & SELLARDS (A. W.). **The Susceptibility of the Mosquito *Aedes triseriatus* to the Virus of Yellow Fever under experimental Conditions.**—*Ann. trop. Med. Parasit.* **33** no. 1 pp. 101–105, 8 refs. Liverpool, 1939. [Cf. R.A.E., B **27** 121.]

DIAS (E.) & MARTINS (A. V.). **Spotted Fever in Brazil. A Summary.**—*Amer. J. trop. Med.* **19** no. 2 pp. 103–108, 45 refs. Baltimore, Md., 1939.

LAAKE (E. W.). **On the Hydrogen-ion Concentration of Myiotic Wounds and its Relation to the Oviposition Stimulus in *Cochliomyia americana* C. and P. [*hominivorax*, Coq].**—*Amer. J. trop. Med.* **19** no. 2 pp. 193–197, 3 figs., 1 ref. Baltimore, Md., 1939. [Cf. R.A.E., B **26** 236.]

POPESCU-BARAN (M.). **Présence de larves d'*Hypoderma bovis* dans le canal rachidien de génisses atteintes de myélite étendue** [Presence of larvae of *Hypoderma bovis* in the spinal canal of heifers suffering from extensive myelitis].—*Bull. Soc. Path. exot.* **32** no. 2 pp. 157–159. Paris, 1939.

PATTON (W. S.). **The Terminalia of the Genus *Wohlfahrtia* B. & B., and those of some allied Genera, together with Notes on the Natural Grouping of the Species of the Subfamilies Sarcophaginae and Miltogrammatinae.**—*Bull. Soc. Fouad 1er Ent.* **22** (1938) pp. 67–109, 35 figs., 9 refs. Cairo, 1939.

KRÖBER (O.). **Katalog der palaearktischen Tabaniden nebst Bestimmungstabellen und Zusätzen zu einzelnen Arten sowie Neubeschreibungen.** [A Catalogue of the Palaearctic Tabanids with Keys and supplementary Notes to individual Species as well as Descriptions of new Species.]—*Acta Inst. Mus. zool. Univ. Athen.* **2** fasc. 3–4 pp. 57–245. Athens, 1939.

MUSCHAMP (P. A. H.). **Gadflies [Tabanids] in the Savoy Alps, 1938.** *Ent. Rec.* **51** no. 4 pp. 49–55, 1 pl. London, 1939.

OHASHI (S.). **Seasonal Change of the Bacteriophage-occurrence in Feces of Animals and in Flies.**—*J. Shanghai Sci. Inst.* **4** no. 4 pp. 141–150. Shanghai, 1939.

SPARROW (H.). **Infection spontanée des poux [Pediculus humanus, L.] d'élevage par une rickettsia du type *Rickettsia rocha limae*.**—*Arch. Inst. Pasteur Tunis* **28** no. 1 pp. 64–73, 6 refs. Tunis, 1939. Slightly shorter version in *Bull. Soc. Path. exot.* **32** no. 3 pp. 310–316, 6 refs. Paris, 1939.

SERGENT (A.). **La fièvre récurrente hispano-nord-africaine en Algérie** [including data on transmission of *Spirochaeta hispanica* by *Rhipicephalus sanguineus*, Latr].—*Arch. Inst. Pasteur Algérie* **16** no. 4 pp. 403–450, 1 pl., 17 figs., 17 refs. Algiers, 1938. [For shorter account see R.A.E., B **27** 36.]

DE MEILLON (B.). **New Fleas from South Africa** [two species, including *Xenopsylla occidentalis*, sp. n.].—*Z. Parasitenk.* **10** pt. 4 pp. 464–467, 6 figs. Berlin, 1938.

HASSALL (A.), DOSS (M. A.), FARR (M. M.), CARSON (G. B.) & BERO (D.). **Index-catalogue of Medical and Veterinary Zoology. Part 3. Authors: C to Czygan.**—pp. 613–961. Washington, D.C., U.S. Dep. Agric., 1939. Price 40 cts. (from Supt. Documents). [Cf. R.A.E., B **26** 80.]

JOHNSON (C. G.) & MELLANBY (K.). **Bed-Bugs and Cockroaches.**—*Proc. R. ent. Soc. Lond. (A)* **14** pt. 2-3 p. 50, 3 refs. London, 1939.

There is a widespread belief that cockroaches eat bed-bugs and so exercise a certain degree of control over them, but the authors' experiments, of which two are described, gave no indication that *Cimex lectularius*, L., is attacked by *Blatta orientalis*, L., to any great extent.

BRUMPT (E.). **Les parasites du paludisme des chimpanzés.**—*C. R. Soc. Biol.* **130** no. 9 pp. 837-840. Paris, 1939.

The author reviews the literature on the identity of the three species of *Plasmodium* found in apes (chimpanzees and gorillas) in Africa and concludes from illustrations and from preparations that they differ from those that infect man and monkeys. The species resembling *P. falciparum* has already been named *P. reichenowi* [R.A.E., B **12** 100], and he proposes the names *P. rodhaini* and *P. schwetzi* for those resembling *P. malariae* and *P. vivax* [**9** 129] respectively.

SHANNON (R. C.). **Methods for collecting and feeding Mosquitoes in Jungle Yellow Fever Studies.**—*Amer. J. trop. Med.* **19** no. 2 pp. 131-138, 2 pls., 2 refs. Baltimore, Md., 1939.

Descriptions are given of the apparatus and methods used for capturing, transporting, identifying and feeding the mosquitos used in the experiments in which yellow fever was transmitted to laboratory animals by the bite or the injection of Brazilian jungle mosquitos [R.A.E., B **27** 121]. The traps, which were each baited with a horse, were made of muslin and mosquito netting and suspended from trees by cords so that they could easily be rolled up and taken from one place to another.

The daily feeding records show that the percentage of individuals that fed in the laboratory was usually 50 or more in the species of *Mansonia*, *Psorophora*, *Aëdes* and *Huemagogus*, but only about 25 in most of the species of *Sabethes*, *Wyeomyia* (*sens. lat.*), *Goeldia* and *Trichoprosopon*. An average of only 15 per cent. of the examples of *Aëdes terrens*, Wlk., fed. The percentages among the examples of *Psorophora ferox*, Humboldt, and *A. serratus*, Theo., from Rio de Janeiro were higher than among those from Matto Grosso; the reverse was true of *A. scapularis*, Rond. The percentages of *A. aegypti*, L., that fed in three tests carried out during the same period were 22, 35 and 56, but in the first test, honey was provided up to the day of the blood meal, in the second, it was removed 3 days before, and in the third, the mosquitos were only 2-3 days old and up to the day of feeding had been provided only with water.

BOYD (M. F.), KITCHEN (S. F.) & MATTHEWS (C. B.). **Consecutive Inoculations with Plasmodium vivax and Plasmodium falciparum.**—*Amer. J. trop. Med.* **19** no. 2 pp. 141-150, 2 refs. Baltimore, Md., 1939.

In the experiments described, patients were subjected during the incubation period, during the clinical attack or following an attack

of malaria due to *Plasmodium vivax* or *P. falciparum* to the bites of females of *Anopheles quadrimaculatus*, Say, infected with *P. falciparum* or *P. vivax*, respectively. From the results, it is concluded that there is an absence of cross-immunity between these two parasites.

MACCREARY (D.). **The Influence of Mosquitoes on Milk Production in Delaware.**—*Bull. Del. agric. Exp. Sta.* no. 213, 21 pp., 7 figs. Newark, Del., 1938.

It has frequently been asserted, apparently on very inadequate grounds, that milk production in cows is reduced when mosquitos are prevalent. From a study of milk production on not less than 47 farms in each of two areas in Delaware in which records were available for three years (1928-30) before mosquito control measures were instituted and for three years (1934-36) while they were being carried out, and from a comparison over a period of two years (1935-36) of the milk production on a particular farm with the numbers of mosquitos caught in a trap operated in the vicinity, the author concludes that over a period of time economic losses attributable to mosquito prevalence are probably comparatively small. There was only one instance during the investigations in which mosquitos may have contributed to a decrease in milk production, but even in this case definite proof was lacking.

REMLINGER (P.) & BAILLY (J.). **Développement possible du virus rabique dans l'organisme de la tique du chien (*Rhipicephalus sanguineus*).**—*Ann. Inst. Pasteur* **62** no. 4 pp. 463-467. Paris, 1939.

After pointing out the difficulty that has been experienced in recovering the virus of rabies from the blood of infected animals, the authors give details of two cases in each of which it was shown (by inoculation into laboratory animals) to be present in a batch of the tick, *Rhipicephalus sanguineus*, Latr., removed from an infected dog.

OZWALD (B.). **Ponte du *Rhipicephalus bursa* dans des conditions favorables.**—*Ann. Parasit. hum. comp.* **17** no. 2 pp. 170-173, 1 graph. Paris, 1939.

Eight females of *Rhipicephalus bursa*, C. & F., of which three were completely and five partly engorged, were kept separately in Petri dishes in an incubator at a temperature of 25°C. [77°F.]. The numbers of eggs laid daily by each tick are shown in a table and in a graph, which also gives the atmospheric pressures for this period. Under these favourable conditions, the oviposition period lasted 21-23 days; the maximum daily numbers of eggs were always laid within the first quarter of it. The total numbers deposited ranged from 5,036 to 4,515 in the engorged individuals and from 3,709 to 2,017 in the others. The smaller numbers of eggs laid by the incompletely engorged females were due not to a shortening of the oviposition period, but to a lower daily rate. The course of oviposition, which was continuous, was not apparently affected by moderate fluctuations in atmospheric pressure. The ticks died 1-2 days after oviposition ceased.

BRUMPT (E.). Un nouveau tréponème parasite de l'homme : *Treponema carateum*, agent des caratés ou "mal del pinto."—*C. R. Soc. Biol.* **130** no. 10 pp. 942-945. Paris, 1939.

The author reviews information concerning a disease that occurs in man in Central America, the Antilles and the northern part of South America and which was found in 1938 to be caused by a spirochaete that is here described as *Spirochaeta (Treponema) carateum*. Various insects, particularly species of *Simulium*, have been suggested as possible vectors, but the author points out that he found ticks of the genus *Ornithodoros* in large numbers, when, in 1932 and 1938, he visited villages in Mexico in which the disease was prevalent.

GWATKIN (R.) & FALLIS (A. M.). Bactericidal and Antigenic Qualities of the Washings of Blowfly Maggots.—*Canad. J. Res. (D)* **16** no. 12 pp. 343-352, 7 refs. Ottawa, 1938.

The following is substantially the authors' abstract : Washings of mixtures of maggots of *Calliphora erythrocephala*, Mg., *C. latifrons*, Hough, *C. vomitoria* var. *nigribarba*, Shannon, and *Cynomyia cadaverina*, R.-D., and of *C. erythrocephala* alone, showed bactericidal activity against *Staphylococcus aureus*, *Streptococcus mastitidis*, *Brucella abortus* and *Bacillus typhosus*, *in vitro*. Flies were successfully reared in the laboratory, but washings from their maggots became less active with each generation. The pH value of active samples was generally greater than that of poor samples. Attempts to increase activity by rendering poor washings alkaline were unsuccessful. Diluted washings showed some bactericidal power. The keeping quality of liquid samples was poorer than that of dried ones. Washings from meat in which maggots had been reared had a definite bactericidal value, while those from control samples of meat had none. A suspension of maggots ground after washing was also inactive. The addition of *B. abortus* to meat on which maggots were reared did not increase the bactericidal activity of washings from them against this organism. Intraperitoneal injections of washings were toxic to guineapigs. Filtration reduced bactericidal action and toxicity. Serum from a rabbit into which dried samples of washings had been injected had good complement fixing power with an antigen of maggot washings. Intraperitoneal injections of diluted washings failed to protect guineapigs against infection with *B. abortus*, but there was some delay in the development of infection, as indicated by the slower appearance of agglutinins in treated animals.

Entomological Problems.—*Rep. Coun. sci. industr. Res. Aust.* **12** (1937-38) pp. 14-22. Canberra 1939. **Animal Health and Nutrition Investigations.**—*T.c.* pp. 27-37.

This report on the work carried out in Australia by the Divisions of Economic Entomology and of Animal Health and Nutrition includes a review of the progress of certain investigations connected with the control of sheep blowflies. Preliminary studies on the reactions of the principal sheep blowfly *Lucilia cuprina*, Wied., in the tropometer already described (*R.A.E.*, B **26** 82) showed that young flies of both sexes respond to highly attractive odours more readily than old flies that have been fed on liver, and that starved flies react more readily than flies that have recently been fed.

Distilled water is scarcely attractive, and, in this apparatus, indole is less attractive than liver treated with a sulphide [cf. 26 150], but more attractive than indole plus ammonium carbonate. Hobson's work on the "S" and "P" factors concerned in producing the attractiveness of susceptible sheep for blowflies [cf. 25 52] was repeated and extended at Canberra and the following results were obtained. The "P" substances were attractive apart from the sheep, but their attractiveness was greatly enhanced by exposing them on the backs of sheep. Of the "P" substances tested on sheep, indole plus ammonium carbonate was the most attractive, and indole alone was much more so than the other substances. The relative attractiveness of "P" substances exposed apart from the sheep was not always the same as when they were exposed on it; the addition of acetic acid reduced the attractiveness of indole on the sheep but not off it. Any degree of artificial attractiveness may be produced by treating sheep with appropriately selected "P" substances, but there is as yet no evidence to indicate whether sheep made attractive by artificial means are specifically attractive to gravid females of *L. cuprina*, as struck sheep were found to be. The attractiveness of the "S" factor varied on different parts of the sheep, the wither being twice as attractive as the middle or posterior parts of the back. The greater attractiveness of the wither is inherent in the fleece or skin, since it was demonstrated on sheep in which the whole length of the back was protected from weathering by rugs. The attractiveness of the "S" factor did not vary greatly with sex or age but may have been slightly greater in lambs than in old sheep. The presence of fold fleece-rot increased the attractiveness of the area on which it occurred. Sheep that had been covered with a rug were less attractive than those that had not been covered. Sheep also showed individual differences in attractiveness, the reasons for which have not been elucidated.

In order to obtain accurate results in stomach poison tests, it was necessary to discover a simple standard medium on which uniform growth of maggots could be regularly obtained. The mixture finally evolved contained only yeast and salt in an inert agar basis; although adequate growth was obtained on it, the fact that the addition of various mildly toxic agents seriously interfered with development showed that it was very close to the basal limit, and consequently for certain tests it was enriched by the addition of egg albumen. The evidence suggested that the toxicity of stomach poisons was higher when the nutritive value of the medium on which the larvae were fed was low than when it was high. The work shows that maggots can be reared in the absence of animal protein and confirms previous observations that the materials present in the normal fleece, whether it is soiled with urine or not, do not assist their growth. Recent studies have shown that maggots that develop in and escape from the bait pan of a trap may produce as many flies as are caught by the trap. Work on this problem confirmed the value of borax in preventing maggot development without reducing the attractiveness of the bait [cf. 26 151]. Borax becomes ineffective if the bait is flooded by rain, but no other preparation proved so useful, although nicotine sulphate gave fairly good results.

A series of experimental dippings in known arsenicals indicated that the soluble forms are more effective against lice and "ticks" [*Melophagus ovinus*, L.] infesting sheep than the insoluble ones and that the pentavalent form is less effective than the trivalent one.

GILL (D. A.) & GRAHAM (N. P. H.). **Studies on Fly Strike in Merino Sheep.** No. 1. **The Effect of Mules' Operation on the Incidence of "Crutch" Strike in Ewes.**—*J. Coun. sci. industr. Res. Aust.* **12** no. 1 pp. 53–70, 6 graphs. Melbourne, 1939. No. 2. **Miscellaneous Observations at "Dungalear" on the Influence of Conformation of the Tail and Vulva in Relation to "Crutch" Strike.**—*T.c.* pp. 71–82, 2 pls., 13 refs.

In the first paper, a complete account is given of the results of an experiment to test the value of Mules' operation in preventing blowfly infestation of the crutch of Merino sheep in Australia, a preliminary report on which has already been noticed [*R.A.E.*, B **26** 109]. It is concluded that the removal of folds from the crutch, properly performed, is highly successful as a means of reducing the incidence of infestation in this region. The operation is easily and quickly carried out, causing only transitory pain, and the wounds heal with remarkable rapidity. The wounds do not appear to be particularly attractive to blowflies, but there is always the danger of strike if the operation is carried out during periods of the year when blowflies are active, and in any case, during the summer months, the sheep would be severely irritated by the swarms of small bush flies, *Musca pumila*, Macq. (*velutissima*, Wlk.), that cluster round wounds. Although the operation may have an indirect effect on the general incidence of strike by reducing the breeding grounds of primary flies, it cannot be expected to have a direct effect on strikes in other situations, so that tail strikes should be excluded when its efficacy is being considered. In this carefully controlled experiment, which lasted for 14 months and involved 650 sheep, there were at least 13 and at most 22 crutch strikes among control sheep for every one such strike among treated animals. The need for treating again sheep that had not been adequately dealt with on the first occasion was clearly demonstrated. When allowance was made for this factor, the ratios rose from 13·1 and 22 : 1 to 23 : 1 and 46 : 1, respectively.

In the second paper, an account is given of a study undertaken during the course of the experiment on factors, other than the presence of crutch folds, that have been said to increase susceptibility to fly strike in the breech area. These include malformation of the vulva through accident or disease [cf. **26** 4] and the length of the tail. It is concluded that in this experiment, the length of the tail did not influence the deflection of the vulva, that the incidence of crutch strike was higher in the sheep with short tails (although no obvious explanation was found), that the length of the tip of the vulva had no effect on the intensity of crutch strike, and that minor degrees of deflection, which are common, are evidently not a serious factor in inducing urine-staining of the wool in the breech. No case of gross deflection or distortion of the vulva was observed. Tail strike affected 11 per cent. of the treated sheep and 18 per cent. of the control sheep in this experiment. The authors consider that strike would probably have been markedly less if the tails had been left long enough for the sheep to be able to lift them clear during urination, and if the bare skin from the under side had been pulled over the stump instead of the wool-bearing skin from the upper side, since the wool growing inwards from the latter inevitably becomes stained with urine as soon as it is long enough. Moreover, when tails are docked very short, large tail

folds sag inwards from either side so as to meet each other in the space normally occupied by the tail stump. The deep cleft so formed afforded good protection for maggots. With regard to the possible effect of Mules' operation on selection for breeding purposes, the authors consider that the undesirable wrinkly types are not disguised by the operation.

DINULESCO (G.). *Contribution à l'étude des hypodermes en Roumanie et des préjudices qu'ils causent à l'industrie de la pelleterie.*—*Ann. Inst. nat. zootech. Roum.* **6** repr. 36 pp., 7 pls., 1 fldg map, 19 refs. Bucarest, 1938.

A detailed account is given of investigations in 1936-37 on *Hypoderma bovis*, DeG., and the damage it causes in Rumania. Data were obtained by examining infested cattle slaughtered at the abattoir at Bucarest, rearing in the laboratory the larvae collected from them, and inspecting hides of cattle at the two most important tanneries in Rumania.

The following is almost entirely taken from the author's summary : Larvae occurred under the skin from the beginning of February to the beginning of July, being present in decreasing numbers from May onwards. The pupal period was 17-23 days in the case of males and 15-26 days in the case of females. Adults were present from the beginning of June to about the middle of August, the males living 2-11 days and the females 2-14. Descriptions are given of the third- and fourth-instar larvae, particularly their buccal apparatus. Two types of tumour on the backs of cattle are distinguishable, namely, those in which larvae are developing and those found after this period. The lesion produced during the developmental period of the larva does not heal if it dies in the warble, for the local inflammatory action continues practically to the end of the period of larval development in the following year. Histo-pathological analysis showed that fibro-conjunctive tumours of the type produced by intense chronic inflammation due to foreign bodies are formed beneath the skin.

The perforations in the skin vary in diameter from 2 to 6 mm. The number of perforations varied from 34 to 84 in calves, from 88 to 924 in heifers of 1-2 years old and from 64 to 664 in older animals ; the average for animals examined over more than a year was 224. After the larvae leave the animal, the holes are obturated by cicatrisation, which lasts until the following year. The examination of raw hides and the counting of visible tumours does not give an accurate idea of the depreciation due to infestation, since a partial scraping of the skin always reveals many more perforations, the number depending on the season of the year at which the animal was slaughtered. The examination of tanned hides showed that the commercial value of infested ones is reduced by 60 per cent. In 1937, the percentage of skins damaged by infestation varied from 3 to 53.33, the average for the whole country being 17.66.

NATVIG (L. R.). *Er Hypoderma lineatum De Villers almindelig i Danmark?* [Is *H. lineatum* common in Denmark?]—*Ent. Medd.* **20** no. 4 pp. 222-230, 3 figs., 16 refs. Copenhagen, 1939. (With a Summary in English.)

In connection with his work on the species of *Hypoderma* infesting cattle in Norway [R.A.E., B **26** 84], the author examined material

from the Zoological Museum of the University of Copenhagen and found that several specimens labelled *H. bovis*, DeG., were *H. lineatum*, Vill. He discusses characters distinguishing the larvae of the two species [cf. 26 85] and concludes that *H. lineatum* is commoner in Denmark than has been supposed.

TRAGER (W.). Further Observations on Acquired Immunity to the Tick *Dermacentor variabilis* Say.—*J. Parasit.* 25 no. 2 pp. 137–139, 2 refs. Lancaster, Pa, 1939.

Experiments to supplement those already noticed [R.A.E., B 27 172] showed that guineapigs can be partly immunised against infestation with larvae of *Dermacentor variabilis*, Say, by injecting into them extracts of the cephalic glands, salivary glands or digestive tract of partly engorged adult female ticks or of the salivary glands of unfed adult females. Moreover, the serum of rabbits previously infested with *D. variabilis* showed specific complement fixation with a larval tick extract antigen.

ROBINSON (W.) & BAKER (F. C.). The Enzyme Urease and the Occurrence of Ammonia in Maggot-infected Wounds.—*J. Parasit.* 25 no. 2 pp. 149–155, 22 refs. Lancaster, Pa, 1939.

The following is the authors' summary: The larvae of *Lucilia sericata*, Mg., recently used as surgical maggots, contain the enzyme urease in their tissues and excretions. Urease is present both in non-sterile maggots and in those reared under aseptic conditions. This enzyme, in breaking down urea, produces ammonia abundantly in maggot-infected wounds.

ADLER (S.) & THEODOR (O.). The Behaviour of *Leishmania chagasi* in *Phlebotomus papatasii*.—*Ann. trop. Med. Parasit.* 33 no. 1 pp. 45–47, 6 refs. Liverpool, 1939.

With regard to the method of feeding sandflies on suspensions of *Leishmania* through a membrane [cf. R.A.E., B 15 221], it is pointed out that so far it has been possible to apply it only to *Phlebotomus papatasii*, Scop., since *P. sergenti*, Parr., and sandflies of the group of *P. major*, Ann., rarely feed through membranes. It has been found that relatively few examples of *P. papatasii* feed through the membrane unless the fluid on which they are allowed to feed contains red cells, but a large though varying proportion (up to 80 per cent.) feed if the membrane is first covered with a solution of cane sugar, which is allowed to dry on its surface. Apparently testing the sugar stimulates the acts of piercing and of pumping fluid into the alimentary canal. The advantage of the method is that the infectivity of various strains and species of *Leishmania* can be compared quantitatively, since the volume of the fluid ingested by the fly is fairly constant and suspensions of flagellates can be made to any desired concentration. *P. papatasii* is naturally resistant to some strains of *Leishmania* [cf. 19 121; 26 257], but the resistance can be reduced by feeding them through a membrane on large numbers of flagellates, or in the case of the Cretan strain of *L. tropica* 26 257, by reducing the proportion of serum in the nutrient suspension. Once the resistance has been broken down, the behaviour of the flagellates in their artificial host (*P. papatasii* in the case of all Old World species of *Leishmania*) gives a fair indication of their behaviour in their natural host, except

that short-form infections, such as occur in *P. perniciosus* infected with *L. infantum*, have not yet been found in *P. papatasii* infected with this species.

The following is taken from the authors' summary of experiments carried out in Jerusalem to determine the behaviour of a number of strains of *L. chagasi*, obtained from Brazil, where it is the causal agent of visceral leishmaniasis [cf. 26 89; 27 158]: *Phlebotomus papatasii* was infected with *L. chagasi* by feeding on suspensions of flagellates. The infection rates were 24, 71 and 89 per cent. when the sandflies were fed on suspensions containing 300, 1,000–2,000, and more than 2,000 flagellates per 0.1 cu. mm., respectively. The flagellates adopt an anterior position, and attaching themselves to the epithelium of the cardia, pass through the oesophagus; they have been traced to the anterior end of the pharynx after 5 days.

BERBERIAN (D. A.). A second Note on successful Transmission of Oriental Sore by the Bites of *Stomoxys calcitrans*.—Ann. trop. Med. Parasit. 33 no. 1 pp. 95–96, 1 ref. Liverpool, 1939.

In the first part of the paper, the author describes in detail the development of the two sores produced in a previous experiment on transmission of *Leishmania tropica* by *Stomoxys calcitrans*, L. [R. A. E., B 27 133]. The papules were so close together that they fused into one lesion in April 1938, and *L. tropica* was successfully obtained from it in culture. In July 1938, 3 examples of *S. calcitrans* were allowed to feed on the lesion and were immediately transferred to the thigh of a volunteer. The flies bit the sore 10 times and the thigh 5 times. Two papules appeared at the site of the bites on 14th and 29th December, respectively. Examination of smears prepared from these lesions showed numerous Leishman-Donovan bodies. Four volunteers were used in the first series of experiments [*loc. cit.*] and three in the second, and in each case one of them developed two lesions.

BLAIR (D. M.). Human Trypanosomiasis in Southern Rhodesia, 1911–1938.—Trans. R. Soc. trop. Med. Hyg. 32 no. 6 pp. 729–742, 1 map, 10 refs. London, 1939.

An outline is given of the distribution of tsetse flies in Southern Rhodesia, where the most important species is *Glossina morsitans*, Westw. The history of sleeping sickness in the colony is described from the time it was first mentioned in 1909 up to 1938, together with the details of cases found at or connected with a focus of the disease located at Gowe during medical surveys made by the author in 1934. He states that his experience in this area lends little support to the view that *Trypanosoma brucei* and *T. rhodesiense* are the same organism. In Southern Rhodesia, many thousands of square miles are infested with *G. morsitans*, but *T. brucei* is not commonly found. In the course of 30 years, sleeping sickness has occurred in only one or other of two very circumscribed areas, and in these areas the density of the population has always been low, whereas in other parts of the fly belt it is quite high. Since there is a constant stream of immigrant natives from infected areas in the north passing through fly belts on the paths into Southern Rhodesia, it would be expected that foci of human infection would have been established long ago if game animals had been the reservoir. His impression is that a local outbreak

of the disease always follows the establishment of the man-fly-man cycle and that the reservoir is man. Two "healthy carriers" [cf. R.A.E., B 25 17] were discovered at Gowe, where tsetse flies were not only abundant in the bush but also appeared to live in large numbers actually within the village. These flies probably fed almost exclusively on man and goats and rarely came into contact with game animals. Acute cases of the disease would appear to be of little epidemiological importance, since they soon retire to their huts away from contact with the fly. The genesis of the "carrier" state is discussed. The flies in the village, although they may have been infected by biting the two carriers, were apparently unable to produce any acute cases in the other inhabitants, although they were able to infect quite a large proportion of the casual visitors, both native and European, who had either never been exposed to fly before or exposed only to low densities. It is suggested that uninfected flies may pass on by their bites some substance that produces a stimulation of the immunity mechanism of the human body, so that when trypanosomes are introduced into the circulation by an infected fly, they are either eliminated or exist in such small numbers that in time a state of parasite-host tolerance is attained and the condition of "healthy carrier" is reached.

Report of the Sleeping Sickness Service, 1937.—Rep. med. Serv. Nigeria 1937 pp. 67–73. Lagos, 1939.

The entomologist [T. A. M. Nash] reports on a partial clearing experiment and on an investigation on breeding sites of *Glossina* during the rains in Northern Nigeria. Meteorological data and data on the density and reproduction of tsetse flies in two separate residual forest islands were recorded for one year, after which one of the islands was partly cleared, the other being kept as a control. Dense masses of thicket were removed, but valuable timber trees and their seedlings were left. It is hoped that this will result in the occurrence, during the hot season, of temperatures sufficiently high to exterminate the fly.

In 1936, it was found that the Nigerian race [*submorsitans*, Newst.] of *G. morsitans*, Westw., evacuates the residual forest islands and thickets during the rains and breeds in dry places under logs in the open woodland savannah; thus for a few weeks its habits resemble those of the typical East African race [cf. R.A.E., B 25 161]. In 1937, it was discovered that *G. tachinoides*, Westw., breeds during the rains under the fan-shaped leaves of seedling palm trees growing in the woodland outside the forest islands. The rain pours down the v-shaped leaflets and runs off their tips, leaving at the base a completely dry patch of soil, and puparia were found in these minute dry patches throughout the rains. These breeding sites are evacuated at the end of the rains, and reproduction takes place in small thickets; these are then evacuated in favour of the more extensive forest islands, and, finally, during the hot season, breeding occurs in the moist sand of the river bed beneath the banks. Each evacuation is preceded by a sudden increase in pupal mortality, which is believed to be due to the water content of the soil falling below a certain safety level. The approach of this condition is in some manner associated with the females' evacuation of the site, since breeding is invariably on the wane before the high pupal mortalities occur. It is possible that when the soil is becoming too dry, increased surface evaporation drives the females to seek a more favourable micro-climate.

WANSON (M.). *Observations sur la biologie des cératopogonidés et des simuliidés du Bas Congo.*—*Ann. Soc. belge Méd. trop.* **19** no. 1 pp. 97–112, 13 refs. Brussels, 1939.

Miscellaneous notes are given on the breeding places and feeding habits of various Ceratopogonids found in the coastal region at Banana and inland in the region of Matadi. *Culicoides grahami*, Aust., and *C. austeni*, C., I. & M., have been implicated in the transmission of *Filaria (Acanthocheilonema) perstans* [cf. *R.A.E.*, B **16** 14, 155], but these species were not found in two villages where 57 per cent. of the inhabitants were infected, and it is suggested that *C. trichopis*, de Meillon, which predominated in the collections from these places, is probably the local vector, although dissection of about 100 specimens revealed no microfilaria. At Banana, where 52 per cent. of the population are infected, *C. austeni* is present, although it is not the predominant species, but *C. grahami* has not been taken. It is also suggested that Ceratopogonids may be concerned in the transmission of Congo red fever, a disease thought to be due to a virus and possibly allied to dengue, which is endemic in the Bas Congo and in Mayumba, where these midges, particularly *C. grahami* and *C. austeni*, are widely distributed and more numerous than *Aedes aegypti*, L. [*argenteus*, Poir.]. Cases were also observed in 1934 at Banana, where Ceratopogonids are very numerous, *A. aegypti* is relatively scarce, and no species of *Phlebotomus* are found. On the other hand, the disease is absent from Matadi where *A. aegypti* and, particularly, Ceratopogonids have become very rare but an anthropophilous species of *Phlebotomus*, *P. schwetzi*, Adl., Thdr. & Parr., is common.

Simuliids are absent from Banana, where there is no running water. At Matadi they are of seasonal occurrence, being abundant at the edge of the river Congo from November to January, when they harass the crews of ships at the port. The numerous females caught at the edge of the river all proved to be *Simulium damnosum*, Theo. They bite during the day in full sunlight, but seldom enter houses except when these are near the water. The intense multiplication of the species during the first months of the hot season coincides with the rising of the water in the river, which inundates the steep rocky parts of the banks. When the waters reach their lowest point in June-July, the Simuliids disappear completely from the port on the left bank but are still more or less abundant on the right bank near native villages where the water wets only sandy alluvial soil. In the wet season, the tributaries become torrents that carry down quantities of stones and sand and so are unfavourable as breeding places. In these ravines, clearing and confining the water to a narrow central bed gives excellent control of the larvae. An engorged female of *S. griseicollis*, Becker, was taken in this region in May 1938; this is believed to be the first record from the Belgian Congo. No indigenous cases of onchocercosis have yet been seen at Matadi.

MACNAY (C. G.). *Studies on Repellents for Biting Flies.*—*Canad. Ent.* **71** no. 2 pp. 38–44, 10 refs. Guelph, 1939.

In view of the doubtful value of many of the materials cited in the literature as repellents for blood-sucking Diptera, experiments have been carried out with the ingredients of these materials that could be regarded as of potential value. The technique of the experiments is

described ; the tests were all carried out by smearing the substance on the arms of a single person and noting the time elapsing before the first four or five bites were received. Since it was found that comparative tests with the materials alone indicated the degree of volatility of some of them rather than their repellent effect, in all later experiments the repellent material was incorporated in olive oil, which was chosen as a carrier because it lasted longer than glycerine or petrolatum, it was fairly easily removed with soap and water, and it neutralised the burning effect on the skin produced by many of the materials tested. The mosquitos prevalent in the fairly densely wooded areas in Ontario in which the work was carried out were chiefly *Aëdes sticticus*, Mg. (*hirsuteron*, Theo.), *A. stimulans*, Wlk., *A. vexans*, Mg., and *A. trichurus*, Dyar. The results are shown in a table. Pyrethrum was the most promising of the materials tested, but it is essential that it be of good quality and known strength. The material used in the tests was a mineral-oil extract of pyrethrum, of which 1 fl. oz. contained the extract of approximately 0·2 lb. pyrethrum flowers. Various forms of the essences of thyme and geranium gave promising results. Cinnamic aldehyde and cresol, although comparatively effective, irritated the skin too severely to be used at any appreciable concentrations. Thymol, citral, hederoma and caprylic alcohol were also very irritating to the skin. Phenyl salicylate, bay laurel, pine oil, clove and citronella, although not so effective as the materials already mentioned, possessed a definite repellent value. The fractions of oil of tar obtained by distillation were all apparently fairly effective and free from the objectionable properties of the original material, since the pigmented portion of the oil remains in the residue resulting from the process of distillation ; the upper fractions are comparatively inexpensive, and unlike many of the essential oils and extracts, do not deteriorate. A mixture containing extract of pyrethrum in castor oil with enough oil of thyme to mask the odour of the oil without irritating the skin [R.A.E., B 27 14] is recommended.

BLISS (C. I.). Fly Spray Testing. A Discussion on the Theory of evaluating Liquid Household Insecticides by the Peet-Grady Method.—*Soap* 15 no. 4 pp. 103, 105, 107, 109, 111, 13 refs. New York, N.Y., 1939.

The author outlines the steps in the development of the present method of evaluating liquid household insecticides in the United States and points out that although it is now possible to state that a given sample is more or less toxic than the Official Control Insecticide [*cf.* R.A.E., B 27 23], no means has yet been found for determining exactly the extent of the difference between the two. He then describes a method for doing this, which is based on determining the amount of standard (O.C.I.) that will give the same mortality among flies as a unit of the sample. For example, if half a unit of standard gives the same mortality as one unit of the sample, the latter would be rated as having a toxicity of 0·5 or 50 per cent. He discusses the dosage-mortality curves and their transformation into straight lines by the method of probits [*cf.* A 22 440; 23 493], the significance of the slope of these lines, the necessity for basing tests on larger numbers of flies when both sexes in equal numbers are used to obtain the same precision as when the sexes are used separately, and the probability

that only two dosages of standard and of unknown are necessary in order to determine the slopes of the dosage-mortality curves to be used in computing the toxicity of the unknown from the mortality produced in comparison with the standard. He also points out the necessity for minimising responses attributable to factors other than differences in dosage or relative toxicity [cf. B **26** 86, 244; **27** 22], for making comparisons only between the results of tests made on the same culture of flies (since there appears to be an indisputable and apparently uncontrollable difference between cultures even in the same laboratory), and for repeating tests on two or more cultures until the toxicities computed independently agree within the experimental error. The general character of the calculations to be used in computing toxicity is indicated.

HATCH (M. H.). **A bibliographical Catalogue of the injurious Arachnids and Insects of Washington.**—*Univ. Wash. Publ. Biol.* **1** no. 4 pp. 163–223. Seattle, Wash., 1938.

This is a catalogue, in systematic order, of Arthropods that are known to be injurious in the State of Washington, with references to the literature on their occurrence there. They comprise 641 species belonging to 18 orders. The references are stated to be of very unequal value and range from monographs and detailed technical studies to purely popular articles and those that merely mention the occurrence of the species. Indices to common names, and to the orders, families and genera are appended.

JELLISON (W. L.). **Sylvatic Plague : Studies of Predatory and Scavenger Birds in relation to its Epidemiology.**—*Publ. Hlth Rep.* **54** no. 19 pp. 792–798, 8 refs. Washington, D.C., 1939.

In the course of studies on sylvatic plague made in the epizootic area of south-western Montana in 1936, it was observed that flesh-eating birds of numerous species were unusually abundant. Their numbers and their dependence on rodents as an important source of food suggested that they might play a part in the epidemiology of the disease, and studies to elucidate this point were therefore undertaken in a part of the above-mentioned area during the summers of 1936 and 1937. The flesh-eating birds present comprised eagles, hawks and owls, which are predators, and magpies and crows, which are scavengers. In 5 instances the carcasses of ground squirrels (*Citellus richardsoni*) that had been partly eaten by birds were found to be infected with plague. Moreover, it was found that carcasses may be attacked immediately after death while they may still be highly infectious and before they have been entirely deserted by fleas. Scavenger birds seldom carry entire carcasses to their nests and are probably of slight importance in the transport of fleas; examination of a number of adults, young and nests of crows and magpies revealed only one rodent flea. On the other hand, even the smaller predatory birds take the carcasses of comparatively large rodents to their nests and so may scatter rodent fleas along their line of flight, at the points where they perch or in their nests. Examination of adults, fledglings and nests of some of these species revealed few rodent fleas in nests of coarse twigs built high in trees or on rocky ledges, which probably do not offer conditions favourable to species of fleas that have become adapted to

the underground nests and burrows of rodents, but proved that such birds do carry rodent fleas. However, débris from the nest of a burrowing owl (*Speotyto cunicularia*), which was about 18 inches underground at the end of a 6-foot tunnel, yielded 109 live rodent fleas belonging to 6 species. It is unlikely that these fleas had survived from the time rodents had occupied the burrow where the nest was situated since their hosts represented rodents of three different families; they were probably parasites of rodents brought to the burrow as food for the fledglings that occupied the nest. The considerable number of the fleas is attributed to the fact that the underground nest of this species of owl, which is the remodelled burrow of some small mammal, furnishes a favourable habitat for rodent fleas and minimised their chances of escape. It would seem that this record indicates the extent to which rodent fleas are transported by raptorial birds far better than the others, since there is no obvious reason why carcasses carried by the other birds should be less heavily infested by fleas than those carried by burrowing owls.

Other experiments, which are described, showed that the casts of birds fed on plague-infected material were infective, but that the faeces were not.

McCULLOCH (R. N.). A Note on Stickfast Fleas. With a Key to the Species recorded in Australia.—*Agric. Gaz. N.S.W.* **50** pt. 2 pp. 98–101, 11 figs., 10 refs. Sydney, 1939.

In Australia, there are several native species of *Echidnophaga* that normally infest marsupials and not birds. Some of them resemble *E. gallinacea*, Westw., which is an important pest of poultry, and like it may attack domestic animals. In view of the possible spread of *E. gallinacea* in Australia and the consequent extension of quarantined areas, the author gives a key to facilitate their rapid and accurate identification. He discusses the identity of the fleas of this genus that were taken in Queensland many hundreds of miles from areas where the poultry pest is known to exist and from New South Wales. These were recorded as *E. gallinacea* [cf. R.A.E., B **26** 109], but he concludes that they were probably *E. perilis*, Jordan, and that A. W. Ferguson in Western Australia in 1923 may have confused this species with *E. gallinacea* [cf. **11** 150]. *E. perilis* and *E. myrmecobii*, Roths., may be found in very large numbers on dogs as well as on rabbits but apparently cause little injury. *E. gallinacea* was first observed on poultry in Western Australia in 1920. It also occurs in the Northern Territory and, in spite of quarantine regulations, has reached the central districts of South Australia, but it has not been found in the four eastern States.

PHILIP (C. B.). Ticks as Vectors of Animal Diseases.—*Canad. Ent.* **71** no. 3 pp. 55–65. Guelph, 1939.

After giving brief notes on ticks, their habits and hosts, the author discusses their relation to disease, pointing out the kinds of causal organisms transmitted and the methods of transmission, and some of the interesting points that have emerged from studies on tick-borne diseases and other types of injury caused by ticks. Tables are given showing the species of spirochaetes, trypanosomes, sporozoa, rickettsiae and bacteria and the diseases due to viruses that are transmitted

naturally or experimentally by ticks ; the spirochaetes of relapsing fever that are transmitted by ticks, giving the species of spirochaete, the vertebrate hosts other than man, the species of tick vector and the region in which the spirochaete occurs ; and the tick-borne diseases of animals in North and South America, Europe, Africa and Asia, giving their vertebrate hosts, tick vectors and mode of transmission.

STEYN (D. G.) & BEKKER (P. M.). **The Toxicity of some Dipping Fluids containing Arsenic and Sulphur.**—*Onderstepoort J. vet. Sci.* **11** no. 1 pp. 247-255, 1 ref. Pretoria, 1938.

The following is based on the authors' summary of experiments on the toxicity to animals of various dipping fluids commonly used in South Africa, carried out in view of the number of cases of accidental poisoning of stock : It appears that in all the more common forms of arsenical preparations, which are soluble in water, the median lethal dose for rabbits can be calculated on the basis of approximately 0.014 gm. As_2O_3 per kg. body-weight. Sheep, cattle and horses are more susceptible to arsenic than rabbits. The m.l.d. of a proprietary lime-sulphur dip diluted as for dipping was approximately 7.5 cc. per kg. for rabbits and 15-20 cc. for sheep. Another lime-sulphur dip and a sodium polysulphide dip showed approximately the same degree of toxicity.

HAMILTON (C. S. P.). **Investigation into the natural Breeding Places of the *Siphunculina funicola* Fly, in Assam.**—*Indian med. Gaz.* **74** no. 4 pp. 210-215, 8 figs., 5 refs. Calcutta, 1939.

An account is given of an investigation carried out from March 1937 to November 1938 to determine the breeding places of *Siphunculina funicola*, De Meij., in the Jura Valley area, Sylhet, Assam, where the fly is a definite nuisance from April to October, as well as being probably concerned in the spread of epidemic conjunctivitis, which is prevalent from March to the end of September (2,227 cases occurred in the Valley during this period in 1937) and possibly a vector of yaws. Although hundreds of samples, including ammoniacal soil from cattle sheds, soil from latrines and drains, decomposing vegetation, and soil found in the galleries of ant heaps, were examined, breeding was only observed in grass thatch from the roofs of dwellings [cf. *R.A.E.*, B **6** 22; **16** 252; **26** 94]. Numerous flies bred from the other samples all proved to be Borborids. Not only were eggs, larvae and pupae found in the thatch, but flies were bred from them, often on the original pieces of thatch without the addition of any other media. In August 1939, the author succeeded in rearing 20 flies from eggs and larvae found on a few strands of thatch grass taken from a bungalow roof. In most cases, dead flies in a disintegrated state were found, together with collections of eggs, in a blackish mass entwined in a web ; the mass may assume a definite roundish shape, become semi-solid, and eventually act as a "cocoon mass" harbouring a larva or pupa. The blackish material found is probably formed from excreta or secretions from the flies themselves [cf. **16** 252]. It was at first thought to originate from deposits of soot, but this was disproved by its presence in the eaves of a bungalow in which there had been no fires. It is, however, not necessary for the larva or pupa to be encased in the black nodules, since they have more often been found lying in

folds of the grass. Material containing eggs was collected on 30th April and adults emerged on 31st May, 11th June and 1st November, so that eggs in thatch must be viable for long periods. Descriptions of all stages are given. Females lay eggs in batches of 5-10; 40 eggs have been dissected from a single fly. The duration of the life-cycle varies greatly with the climate, but under favourable conditions is about 3 weeks.

COVELL (G.). Antimalaria Operations in Delhi. Part I.—*J. Malar. Inst. India* 2 no. 1 pp. 1-61, 13 pls., 6 maps (1 fldg.), 1 chart, 20 refs. Calcutta, 1939.

An account is given of the history of malaria in Delhi, of the various problems connected with Anopheline breeding places in the urban area, and of the distribution and intensity of the disease in that area immediately before the commencement of the anti-malaria campaign in 1936 [cf. *R.A.E.*, B 19 42; 27 7, etc.].

MACDONALD (G.). A Design of Flushing Siphon for Control of Anopheline Breeding.—*J. Malar. Inst. India* 2 no. 1 pp. 63-69, 4 pls., 1 fig., 2 refs. Calcutta, 1939.

The following is almost entirely taken from the author's summary: The control by flushing of Anophelines that breed in streams and rivers is briefly described [cf. *R.A.E.*, B 25 30]. It is suggested that this method has the great advantage of cheapness, complete efficacy, permanence, and lack of need for supervision; it has been used for the control of *Anopheles maculatus*, Theo., in Malaya, *A. culicifacies*, Giles, in Ceylon, and *A. multicolor*, Camb., in Egypt, and it is predicted that it will be found to be a most valuable addition to the methods available for the control of *A. minimus*, Theo., *A. fluviatilis*, James, *A. varuna*, Iyen., *A. culicifacies*, and possibly other species of Anophelines in India. A brief account is given of the type of water to which it is applicable, of the method itself, and of the principles on which an automatic siphon operates. The requirements of a type to suit estate conditions in Ceylon are enumerated, and a detailed account, illustrated by scale drawings, is given of a design that fulfils these. It gives an automatic discharge of 475 gallons of water a minute; it is standardised and made in a central dépôt, and is easily erected by persons without previous experience of this type of work; it is designed for erection either singly or in parallel with others; it necessitates only a low, and therefore cheap and safe, dam; it is of concrete, will withstand rough treatment, and can be retailed at Rs. 25. It is suggested that this design might be adopted wherever similar requirements occur.

MANSON (D.). The Action of certain Assamese Plants as Larvicides.—*J. Malar. Inst. India* 2 no. 1 pp. 85-93, 3 refs. Calcutta, 1939.

An account is given of experiments carried out at Cinnamara, Assam, to determine the effect on mosquito larvae of extracts of parts of certain plants that grow profusely in Assam. Dissection of 34,719 Anophelines between August 1930 and September 1938 showed that the only important local vector of malaria is *Anopheles minimus*, Theo., the larvae of which prefer sunny, unshaded drains and streams. Of the plants studied, *Duranta plumieri* has been used extensively to

shade deep drains and *Polygonum flaccidum* in conjunction with other plants to shade shallow ones. Tests showed that the juice of *Duranta* berries was lethal to larvae of both *Anopheles* and *Culex* at dilutions of 1 : 100 in cold water, and it is suggested that berries falling into water shaded by these plants may have a larvicidal effect. The toxic effects are due to the presence of an alkaloid resembling narcotine. The greenish mucilaginous juice of *Polygonum* killed larvae in 15 minutes, but was not lethal when diluted. The juice of the fruits of *Gardenia campanulata* in water was lethal to Anopheline larvae at dilutions up to 1 : 80. An extract made by boiling the roots of *Zanthoxylum hamiltonianum* for 15 minutes in water at the rate of 1 oz. to 1 pint was lethal to Anopheline larvae when diluted to 1 : 50. It loses its potency after 3 days and becomes inert on the fifth day. The action of *Polygonum*, *Gardenia* and *Zanthoxylum* is due to the presence of saponin, which is dissolved in the cell-sap within the living plant. *Tephrosia vogeli* was introduced from Africa as an alternative to *Tephrosia candida*, which is largely used on tea gardens as a nitrogenous manure. The seeds of the former ground up with water at the rate of 1 oz. seed to 5 oz. water and diluted were not so effective as the preparations of *Gardenia* and *Zanthoxylum*, but extracts in acetone made as recommended by Wilbaux [R.A.E., A 23 213] were effective in dilutions up to 1 : 2,000 in water. The action of *Tephrosia* is due to the presence of deguelin.

RUSSELL (P. F.), RAMACHANDRA RAO (T.) & JACOB (V. P.). *Anopheles subpictus* Grassi, 1899, and *Anopheles vagus* Dönitz, 1902, found naturally infected with Malaria Plasmodia in South-eastern India.—*J. Malar. Inst. India* 2 no. 1 pp. 95-99, 5 refs. Calcutta, 1939.

Dissections were made of 4,728 females of *Anopheles subpictus*, Grassi, taken at catching stations in the Ennore-Nellore area, Madras ; 3,853 guts and 4,722 glands were examined, and malaria parasites were observed in the guts of two specimens, so that the infection index was 0·04 per cent., the oöcyst index 0·05 and the sporozoite index zero. In dissections of 3,654 females of the same species taken at catching stations in the Pattukkottai Field Station area, Madras, 3,556 guts and 3,646 glands were examined, and malaria parasites were found in the guts of two specimens and in the salivary glands of one of these, so that the indices were 0·05, 0·06 and 0·03 per cent., respectively. Dissections were also made of 3,128 examples of *A. vagus*, Dön., taken in the latter area ; 3,081 guts and 3,126 glands were examined, and malaria parasites were found in the salivary glands of one specimen, so that the infection and sporozoite indices were 0·03 per cent. and the oöcyst index was zero.

MATHEW (M. I.). Anopheline Transmitters of Malaria in South Travancore.—*J. Malar. Inst. India* 2 no. 1 pp. 101-104, 2 refs. Calcutta, 1939.

The following is substantially the author's summary : The results are given of dissections of 7,882 female Anophelines from two areas in South Travancore to determine the rate of infection with malaria parasites [cf. R.A.E., B 23 128]. The oöcyst and sporozoite rates were 23·7 and 13·0 per cent., respectively, among 2,602 examples of *Anopheles fluviatilis*, James, 2·3 and 1·6 per cent. among 429 of

A. varuna, Iyen., and 0·5 and 0·3 per cent. among 1,131 of *A. culicifacies*, Giles. There would seem to be no doubt that *A. fluviatilis* is a highly efficient vector of malaria in South Travancore, wherever it occurs, and that *A. varuna* is dangerous. The importance of *A. culicifacies* as a vector in these areas would seem to depend entirely on its prevalence, which appears to vary greatly in adjacent areas.

IYENGAR (M. O. T.). **A Year's Work on Dissection of Anopheles for natural Malarial Infection.**—*J. Malar. Inst. India* **2** no. 1 pp. 105–109. Calcutta, 1939.

The following is substantially the author's summary: Out of 22 species of Anophelines collected in endemic areas in Bengal, only *Anopheles philippensis*, Ludl., *A. minimus*, Theo., and *A. pallidus*, Theo., showed natural infections with malaria parasites. The infection rates were 7·2, 6·0 and 0·5 per cent., respectively, and the sporozoite rates 4·0, 2·5 and 0 per cent. The findings indicate that *A. philippensis* is the most important vector in the plains of Bengal and *A. minimus* in the foothill region.

BRINK (C. J. H.) & DAS CHOWDHURY (D. K.). **Ammonium Sulphate as a combined Fertilizer and Mosquito Larvicide (Abstract).**—*J. Malar. Inst. India* **2** no. 1 pp. 111–112. Calcutta, 1939.

Ammonium sulphate is available in Bombay at a moderate price in almost any quantity, and since it is not poisonous to man and animals, and in low percentages has a beneficial effect on crops that obtain their nitrogen from the soil, experiments were carried out to determine its effect in solution on the breeding of mosquitos. It was found that although *Culex fatigans*, Wied., will deposit eggs in water containing ammonium sulphate in solution, it has a definite preference for tap water, and that in the case of *Anopheles stephensi*, List., this preference is less strong. It was concluded that ammonium sulphate in solution was not deterrent at concentrations of less than 0·05 per cent. and that, although at higher concentrations it was deterrent, it was not inhibitory. In experiments in which egg rafts of *C. fatigans* were placed in jars containing solutions of ammonium sulphate, all larvae died within two days of hatching in concentrations of more than 1 per cent., all died within four days in concentrations of 1 per cent., larval growth was interfered with in concentrations of 0·75 per cent., and pupation was delayed in concentrations of 0·5 per cent. It is concluded that to prevent breeding, the concentration should be not less than 0·75 per cent. Further experiments showed that fully grown Culicine larvae pupate normally even in a concentration of 1·5 per cent., whereas Anopheline larvae all died in concentrations higher than 0·5 per cent. In similar tests using Anopheline and Culicine pupae, adults emerged in all cases, even in a concentration of 2 per cent. Analysis of samples of ammonium sulphate solutions that had been kept in contact with different types of soil for 10 days showed that no appreciable breakdown into free ammonia, nitrates and nitrites had occurred, so that there is no likelihood of any deterioration in its larvicidal effects taking place within that period. The general conclusion is that although ammonium sulphate solutions at strengths of 0·75 per cent. and over prevent mosquito breeding, the recurring cost of the method renders it unsuitable for use in large irrigation areas.

AFRIDI (M. K.). *Aëdes Survey of Hog Island (Abstract)*.—*J. Malar. Inst. India* **2** no. 1 pp. 113–114. Calcutta, 1939.

A list is given of the five species of *Aëdes* collected in the course of a survey of Hog Island, in Bombay Harbour, carried out from 26th to 31st July 1938, with notes on the breeding places of the larvae and the habits of the adults.

VENKAT RAO (V.) & RAMAKRISHNA (V.). *A Text Book of Malaria Control*.—x+149 pp. Waltair, R. S., 1939. Price Re. 1.

This practical book on malaria and its control has been written for the benefit of sanitary inspectors and others who have not had special training in the rudiments of malaria control and yet have to take charge of work against Anophelines in India.

HOLMES (W. E.). *The Adult Anopheles Survey as a routine anti-malarial Measure*.—*J. Malaya Br. Brit. med. Ass.* **2** no. 4 pp. 213–218, 1 figd. map. Singapore, 1939.

The author relates how an increase in breeding of *Anopheles maculatus*, Theo., the only important local vector of malaria, was detected by the increased numbers of adults caught during July and August 1938 in man-baited traps at the edge of the inhabited area of Kuala Lumpur and within the controlled zone that extends for half a mile beyond it, how breeding places outside this zone in recently felled sections of a rubber plantation were located by means of further traps and by larval surveys, and how the numbers caught fell as soon as these areas had been drained and oiled. Unfortunately, it was not possible to prevent the occurrence of cases of malaria, but by the time these were notified, the sources of breeding had been dealt with and the numbers of Anophelines entering the traps on the town boundary had rapidly declined. He points out the danger of adhering too rigidly to a controlled zone extending for only half a mile beyond the area to be protected, and the need for routine adult trapping at fixed points, not only to determine the effectiveness of larval control inside the controlled area but also to provide evidence as to whether the range of larval control is sufficient, since replanting, mining, river deviation and other land disturbances in the adjoining area may at any time render an increase in the width of the protecting zone necessary. It is presumed that adults of *A. maculatus* were entering the inhabited area for about 5 weeks before malaria cases occurred, and that malaria cases continued to be recorded for 5 or 6 weeks after the invading Anophelines had been reduced to insignificant numbers.

SENEVET (G.) & ABONNENC (E.). *Quelques anophélinés de la Guyane française*.—*Arch. Inst. Pasteur Algérie* **16** no. 4 pp. 486–512, 1 pl., 10 figs., 10 refs. Algiers, 1938.

The authors discuss the Anophelines of the series of *Anopheles tarsimaculatus*, Goeldi, and the group *Kerteszia*, with particular reference to the species collected in French Guiana between 1934 and 1938. They describe the male, male hypopygium and larva of *A. inini*, sp. n., and the male and female hypopygium of *A. sancti-elii*, sp. n. They found forms of *A. tarsimaculatus* corresponding to those

described by Curry as var. *aquasalis* and var. *aquacaelestis* 'R.A.E., B 20 93' and agree with the view that the former, which breeds close to the sea, is the typical form and the latter, which was only found inland, is *A. oswaldoi*, Peryassú 'cf. 22 31; 26 18'. The measurements of certain structures of the adult, larva and pupa are given for *A. tarsimaculatus* from French Guiana, Martinique and Guadeloupe and for *A. oswaldoi*, *A. strodei*, Root, *A. ininii* and *A. sancti-elii* from French Guiana. A comparison of the figures indicates that the characters of *A. tarsimaculatus* vary little wherever it is found. It was frequently taken in mosquito nets near the coast, whereas *A. oswaldoi* was never found in them in the forest. Keys are given to the adults of the species of the *tarsimaculatus* group occurring in French Guiana, viz., *A. tarsimaculatus*, *A. oswaldoi*, *A. strodei*, *A. ininii*, *A. sancti-elii* and *A. bachmanni*, Petrocchi 'cf. 26 67' and to the pupae and larvae of the first four.

Two males and a female of *A. (Kerteszia) neivai*, H., D. & K., were reared from larvae found in water taken from bromeliads near the Sinnamarie river, and a single female was taken in the same region while attempting to bite man. The larva and male hypopygium are illustrated, and the pupa is described.

HACKETT (L. W.), RUSSELL (P. F.), SCHARFF (J. W.) & SENIOR WHITE (R.). **The present Use of Naturalistic Measures in the Control of Malaria.**—*Bull. Hlth Org. L.o.N.* 7 no. 6 pp. 1016–1064, 13 figs., 42 refs. Geneva, 1938.

This report is the result of an enquiry into the control of malaria by naturalistic measures 'cf. R.A.E., B 26 180, 230, etc.', which are defined as measures designed to extend or intensify natural processes that tend to limit the production of Anophelines or their contact with man. Naturalistic measures have been reported from various parts of the world and these are critically discussed; they are classified according to whether they are directed against the larvae or adults and to whether they are chemical, physical or biological in character. Of the measures directed against larvae, the chemical ones comprise the pollution of water by introducing industrial or organic wastes or by inducing growth of micro-organisms, and the changing of the salt content of the water. The physical measures comprise sluicing, flooding, diverting streams to effect the natural filling of depressions with silt, altering the water level, drying intermittently, agitating the water surface, setting water in motion or keeping it still, using water in which silt is suspended, shading water or exposing it to sunlight, and drying land by planting trees. The biological measures include the use of fish and other natural enemies and the changing of the fauna and flora by various means. The eight naturalistic measures that have been suggested for dealing with adult mosquitos are creating repellent barriers of odorous plants, administering drugs, such as sulphur, which render perspiration odorous, destruction of resting places by clearing vegetation, creation of plant barriers to flight, rendering bedrooms or houses unattractive as resting places, introduction of natural enemies, destruction during the winter, and deviation by animals. These are all dismissed briefly as being ineffective, except the last, which is discussed at length.

It is pointed out that naturalistic measures may be only partly successful and may be slow in producing results, but that steady

progress is to be preferred to an indefinite postponement of attempts to control malaria, particularly in rural areas where no measures have yet seemed feasible. Stress is laid on the need for further research on the biology of the mosquitoes, for further experimentation with naturalistic measures, and for co-operation with agriculturists, pisciculturists, and other interested persons. The substitution of naturalistic measures for other measures already well-established is not recommended without the most careful and extended field studies and experiments. The larval control measures that have undoubtedly proved successful in certain areas and that may prove to be of more general application are herbage-packing, sluicing, shading and the use of exotic fish. It is pointed out that deviation of adult Anophelines from man to animals is not a measure that can be improvised to protect rural habitations, but is an agricultural policy that should be encouraged in areas where biological studies of malaria vectors indicate that it will eventually prove successful.

HÉRIVAU (A.), RONCIN (P.) & DAO VAN THAI. **Contribution à l'étude du paludisme des Nouvelle-Hébrides. Recherches effectuées à Port-Vila et alentours.**—*Ann. Méd. Pharm. colon.* **37** no. 1 pp. 40-62, 6 graphs. Paris, 1939.

In the course of this account of investigations on malaria carried out at Port-Vila and its environs, on Vaté Island, New Hebrides, in 1937-38, notes are given on the breeding places of *Anopheles punctulatus*, Dönn. [cf. *R.A.E.*, B **14** 111]. These appear to be of all types, but are generally of a temporary nature and are numerous only after abundant rains. Larvae were found in water that was running or stagnant, in the shade or in full sunlight, clear or turbid, fresh or very brackish. They occurred in marshes or small depressions, at the edges of roads, in coconut groves or cacao plantations, in natural holes or in receptacles made by man. Migratory flights are very rare, and the Anophelines found in the villages or in the town are derived from breeding places in the vicinity.

DE MEILLON (B.). **A Note on *Anopheles gambiae* Giles and *Anopheles coustani* var. *tenebrosus* Dönnitz from Southern Africa.**—*S. Afr. med. J.* **12** pp. 648-650, 1 ref. Cape Town, 1938.

In the first part of this paper, the author records the finding, during a two days' visit to the Island of Mozambique, of larvae of *Anopheles gambiae*, Giles, in large underground rain-water cisterns built of concrete and completely closed in except for openings permitting the entrance and withdrawal of the rain water. There are a few of these large cisterns on the island and probably a number of smaller ones in the native quarter, which could not be examined for lack of time. The only other water on the island was in two borrow pits; it was very brackish and no larvae were seen in it. Larvae are transported from the cisterns in barrels to the homes of the inhabitants. There appeared to be very little active malaria at the time of the author's visit, so that the importance of this secondary type of breeding place appears to be that it enables the species to survive until suitable rains have fallen and the preferred breeding places are once more available.

In the second part, the author gives an account of observations on *A. coustani* var. *tenebrosus*, Dönn., which is abundant along the coast of Natal and Portuguese East Africa. He concludes that it is

zoophilous but will bite man readily in the absence of cattle. It will attack man in daylight in the shade, but apparently prefers to feed between 6 and 7 p.m. It does not normally frequent houses, and it makes attempts to leave stables early in the morning. Its apparent absence from dwellings may be due to the fact that collections were always made during the day. It is quite common along the coast of Natal during the winter months when the normal vectors of malaria, *A. gambiae* and *A. funestus*, Giles, are inactive, and so is suspected of taking part in transmission of malaria at that season. Although *A. gambiae* and *A. funestus* were found in a native hut in large numbers, they were not taken in a cattle stall of a neighbouring stable where *A. coustani* var. *tenebrosus* was present in enormous numbers, and only one example of *A. funestus* was taken in a part of the same stable in which several natives slept and which was divided off by a partition that did not extend to the roof. It is concluded that the two anthropophilous species may fail to locate man when cattle are present. This finding also supports the author's contention that the host is located by smell [R.A.E., B 23 230].

ROUBAUD (E.). Le pouvoir autogène chez le biotype nord-africain du moustique commun, *Culex pipiens*, L.—Bull. Soc. Path. exot. 32 no. 2 pp. 172-175, 1 fig., 1 ref. Paris, 1939.

The author describes observations on a strain of *Culex pipiens berbericus*, Roub., obtained from Algeria in 1937, which show that this race may sometimes exhibit autogenesis [cf. R.A.E., B 21 267]. This tendency is often limited to a condition that the author terms sub-autogenesis, in which the ovaries develop to a considerable degree without a blood meal, so that although a blood meal is necessary before oviposition, eggs are deposited within 24 hours of it.

ROUBAUD (E.). Le comportement anthropophile de l'*Anopheles maculipennis labranchiae*, étudié dans les conditions expérimentales en insectarium.—Bull. Soc. Path. exot. 32 no. 3 pp. 295-297, 3 refs. Paris, 1939.

In view of the recent experiments by P. van Thiel and L. Bevere, which show that *Anopheles maculipennis*, Mg., race *labranchiae*, Flni., is anthropophilous when compared with race *atroparvus*, van Thiel [R.A.E., B 27 162, 163], the author describes experiments carried out in 1933, but not previously published, which demonstrated clearly that females of the former race (which at that time was designated a paucidentate strain of *A. maculipennis* from Murcia in Spain [cf. R.A.E., B 20 212]), when released in the "flight chamber" of the insectary, preferred to feed on man rather than animals, even though the animal (a rabbit) was constantly exposed whereas the man was present for not more than half an hour a day at about 11 a.m.

TOUMANOFF (C.). Histoire d'une année d'élevage au Tonkin de *St. fasciata* Théob., *St. albopicta* Skuse et *Culex fatigans* Wied.—Bull. Soc. Path. exot. 32 no. 3 pp. 298-300. Paris, 1939.

Aëdes (Stegomyia) aegypti, L. (*fasciatus*, F.), *A. (S.) albopictus*, Skuse, and *Culex fatigans*, Wied., three species of mosquitos that are common in Indo-China, were reared in Tonkin during 1937-38. The technique used is briefly described; the two species of *Aëdes* were fed

on man, and *C. fatigans* on a guineapig. All three species continued to breed throughout the year; the first two had 18 generations and the third, in which the retarding effect of the colder weather was much more marked, had 15. The average periods required for the life-cycle from adult to adult during the winter (November to March), the wet season (June to September) and the two transition months (April and October) were, respectively, 27, 17 and 19 days for *A. aegypti*, 24, 18 and 20 days for *A. albopictus*, and 66, 13 and 20 days for *C. fatigans*. The average pre-oviposition periods in the same seasons were 13, 13 and 9 days for *A. aegypti* and 11, 8 and 10 days for *A. albopictus*. Autogenesis [cf. R.A.E., B 19 215] was not observed in *C. fatigans*, and attempts to induce it by varying the larval food were unsuccessful.

**Report of Works Progress Administration Official Project 466-24-2-41
(Work Project no. 375).**—34+19 pp. multigraph, illus. Lewes, Del., Mosquito Control Commission, Delaware, 1939.

A detailed account is given of the work carried out in Delaware in 1938 to obtain information on the distribution, breeding places, etc., of *Mansonia perturbans*, Wlk., including trapping records in the rest of the peninsula, which comprises parts of Maryland and Virginia. Lists are given of the other species of mosquitos taken, as well as keys to the adults and larvae. Adults were collected by means of portable suction light-traps resembling the New Jersey trap [cf. R.A.E., B 23 151], 6-volt storage batteries supplying the electricity for the light and fan. Larvae were collected by means of a specially designed sieve which consisted of an open box, 15 ins. square, with a bottom of 20-mesh copper screening permanently attached by strips of moulding to prevent leakage; a tray of 8-mesh screening on a light frame, fitting the inside of the box fairly closely, rested on a flange about 3 ins. from the bottom, attached to each side but leaving gaps at the corners so that the contents of the lower sieve could be poured out easily. A handle that could be folded out of the way when washing the vegetation was used to lift out the tray. An examining tray 2½-3 ins. deep with a bottom of 20-mesh screening and sides of light wood was also found helpful. The technique used in collecting samples and sieving them is described. Larvae of *M. perturbans* occurred only in streams flowing through wooded areas and widening out in some sections to form small "ponds"; none occurred in open ponds or lakes. The breeding places were characterised by having soft bottoms with a thick deposit of old leaves, decayed vegetation, etc., covered by at least a foot of water at all times, and a central stream, usually sluggish but with a considerable amount of fresh water. Suitable vegetation is also necessary; during the survey, larvae were found only on *Scirpus cyperinus* and *Potamogeton natans*, but other plants that might have been suitable at other seasons had been killed off by the time the survey was made.

A study of the time of flight for five days in each of two consecutive weeks at the height of the flight period showed that the maximum peak was almost uniformly around midnight, although a lower peak occurred about 8-9 p.m. It is suggested that the peak represents the hour at which optimum conditions for flight occur. Flight was correlated with temperature below 65°F., but above this point it appeared to be correlated with other factors, probably humidity and wind.

WELCH (E. V.). **Insects found on Aircraft at Miami, Fla., in 1938.**—*Publ. Hlth Rep.* **54** no. 14 pp. 561-566. Washington, D.C., 1939.

Lists are given of the insects captured during routine quarantine inspections on seaplanes arriving at Miami, Florida, from Mexico and Central and South America during 1938. Out of 398 aircraft inspected, 187 harboured insects, and 166 of the 651 insects found were alive. The 40 dead mosquitos taken comprised 6 examples of *Aedes taeniorhynchus*, Wied., 6 of *Culex fatigans*, Wied. (*quinquefasciatus*, auct.), 6 of an unidentified species of *Culex*, 1 of *Mansonia titillans*, Wlk., 18 of *M. indubitanus*, Dyar & Shan., 1 of an unidentified species of *Mansonia*, 1 of *Anopheles albimanus*, Wied., and 1 that was too badly damaged to be identified. The 5 living ones were 3 examples of *C. fatigans*, 1 of *M. indubitanus* and 1 of *A. taeniorhynchus*. No example of *A. aegypti*, L., was taken. House-flies (*Musca domestica*, L.), both living and dead, were the most prevalent insects throughout the year, and midges, gnats and other small flies were the next most numerous. Other insects found were *Stomoxys calcitrans*, L., beetles, ants, wasps, moths, cockroaches, and bugs.

Each aeroplane is sprayed by the steward, using a small hand pump gun, half an hour before landing at Miami and other ports of call, with a spray fluid consisting of one part standardised pyrethrum extract (containing 2 gm. pyrethrin per 100 cc.) and 4 parts highly refined mineral oil having a relatively high flash point. The ventilators are closed during the spraying operations and for 10 minutes afterwards. An effort is made to spray thoroughly all compartments of the aeroplane using between 5 and 10 cc. of the insecticide per 1,000 cu. ft. When the aeroplane is to remain on the ground overnight, it is sprayed after the passengers and crew have disembarked and then closed for the night.

CARNAHAN (C. T.). **A two-year Record of Adult Mosquito Trapping in Dade County, Florida.**—*Publ. Hlth Rep.* **54** no. 15 pp. 608-611. Washington, D.C., 1939.

The introduction of exotic mosquitos into Florida is particularly likely, since Miami is an airport of entry for aircraft from South America and the West Indies. It is, therefore, desirable that the constitution of the normal mosquito population near Miami should be known. For this reason, 6 New Jersey suction light-traps [*cf. R.A.E.*, B **23** 151] distributed over an area 12 miles in length along the coast and $4\frac{1}{2}$ -5 miles wide were operated almost nightly between 10th September 1936 and 13th October 1938 from 6 p.m. to 6 a.m. During this period, 214,285 mosquitos comprising 23 species were collected; the numbers of each species per month are shown in a table. The Anophelines, which formed about 6 per cent. of the total, comprised *Anopheles crucians*, Wied., *A. walkeri*, Theo., *A. quadrimaculatus*, Say, and *A. atropos*, D. & K., in that order of abundance.

CORY (E. N.) & CROSTHWAIT (S. L.). **Some Conservation and Ecological Aspects of Mosquito Control.**—*J. econ. Ent.* **32** no. 2 pp. 213-215. Menasha, Wis., 1939.

In order that measures for the control of mosquitos in Maryland should be carried out in such a way as to disturb as little as possible the wild animals and birds of the region, it was necessary to make an

ecological study of the tidal marshes [cf. *R.A.E.*, B **26** 54]. In this paper, the authors discuss the relation of mosquito breeding to stands of the dominant grasses and sedges, particularly *Scirpus olneyi*, which is one of the principal foods of musk-rats, the effects of ditching on vegetation through changes in water level and salinity and the use of dikes and tide gates to offset unfavourable effects, the relation of salinity to mosquito breeding, the importance of mapping all marsh areas before or during ditching to show the various solid stands of plants, so that changes in the ecological succession can be definitely determined, the possibility of utilising ditches to maintain the water in ponds and so preserve the widgeon grass, *Ruppia maritima*, on which wild duck feeds, and the importance of avoiding the cutting of ditches during the nesting season of ducks.

MACCREARY (D.). Comparative Results obtained by the Use of several Mosquito Traps in a limited Area.—*J. econ. Ent.* **32** no. 2 pp. 216-219, 1 fig., 3 refs. Menasha, Wis., 1939.

As a result of comparing the catches obtained during July 1937 from five suction light-traps of the New Jersey vertical model [cf. *R.A.E.*, B **23** 151] distributed within the boundaries of Newark, Delaware, which enclose an area of about 1,000 acres with a population of approximately 4,500 people, it is concluded that, if no unusual topographical or sanitary conditions exist, one trap is sufficient to provide an accurate basis for estimating the density of the mosquito population in a community of a similar size. The three traps situated in the older and more densely populated part of the town showed rather higher average catches per night than the other two, probably because a greater attraction was exercised by the denser population and because there were larger numbers of water-holding receptacles to facilitate breeding of *Culex pipiens*, L. It is therefore suggested that the trap should be situated in the most densely populated area. Of the 2,455 mosquitos taken, about 47 per cent. were males; this indicates that males are more active than is generally supposed. Details of the catches are discussed.

POWERS (G. E.) & HEADLEE (T. J.). How Petroleum Oil kills certain Mosquito Eggs.—*J. econ. Ent.* **32** no. 2 pp. 219-222, 2 figs. Menasha, Wis., 1939.

The results of tests in which 28 petroleum oils covering a wide range of physical properties were applied undiluted to eggs of *Aëdes aegypti*, L., showed that the mortality, which is low with oils of low viscosity, rises with an increase in viscosity until the latter reaches about 108 Saybolt, after which it gradually falls as the viscosity continues to increase. The highest mortality was obtained with a light spindle oil with a viscosity of 108 and a flash point of 340 (Cleveland Open Cup method) that was extremely non-volatile. Observations and experiments on the possible ways in which the eggs are killed produced no evidence that the oil penetrated the chorion or that chemical reaction between the oil and the chorion took place, but showed that the eggs are destroyed because the coating of oil deprives them of their supply of oxygen. The more nearly perfect the coating, the more rapidly the destruction takes place. The low killing power of certain petroleum oils is probably due to the fact that these oils are not retained for a sufficient period or fail to make a closely applied and complete seal.

HULL (J. B.), DOVE (W. E.) & PLATTS (N. G.). **Experimental Diking for Control of Sand Fly and Mosquito Breeding in Florida Salt-water Marshes.**—*J. econ. Ent.* **32** no. 2 pp. 309–312, 4 refs. Menasha, Wis., 1939.

Descriptions are given of two field experiments carried out in Florida on the control of sandflies (*Culicoides*) and salt-marsh mosquitos. It had previously been shown that ditches dug in mangrove and pickleweed marshes for mosquito control concentrated 95 per cent. of the larvae of *Culicoides* within 10 ft. of the ditch banks [cf. *R.A.E.*, B **22** 109], but even this area of infested soil was still too large to make chemical control economically feasible. An attempt was therefore made to restrict breeding still further by diking a small mangrove marsh and flooding it from a neighbouring river to determine whether breeding could be confined to the narrow strip of marsh along the edge of the artificial lake. Although breeding of *Culicoides* and mosquitos was successfully reduced, the authors consider that the cost of pumping to replace the water lost daily by evaporation and seepage would be too great to make control by flooding economically practicable. In the second experiment, a preliminary account of which has already been noticed [b **23** 268], an area fairly typical of Florida marshes was diked to exclude tide water, and pumps and tide gates were installed to remove rain water. The drying of the marsh was accompanied by a satisfactory reduction in breeding of *Culicoides*. In salt-marsh areas in this part of Florida, ditching, which drains flood water from the surface and admits minnows to the interior of the marsh, is used for the control of mosquitos. This measure is satisfactory in swamps where mangroves grow, since these plants do not prevent the entrance of minnows when the marshes are flooded, but where pickleweed (*Batis maritima*) predominates, minnows fail to penetrate its dense growth when the tide water overflows to only half an inch or so and heavy mosquito breeding is apt to take place. It is suggested that drying the marsh by diking and pumping offers a promising method of control under these conditions, since the experiment mentioned indicated that excess water from rains and tides could be removed by pumping in sufficient time to prevent the completion of development of mosquito larvae.

LAAKE (E. W.) & SMITH (C. L.). **The Development of Immunity in Cavies to the Larvae of *Cochliomyia americana* C. & P.**—*J. econ. Ent.* **32** no. 2 pp. 339–342, 1 ref. Menasha, Wis., 1939.

An account is given of recent experiments carried out in Texas on the immunity produced in guineapigs by sublethal infestation by larvae of *Cochliomyia hominivorax*, Coq. (*americana*, Cush. & Patt.) [cf. *R.A.E.*, B **27** 3].

The following is substantially the authors' summary: The number of larvae constituting a maximum sublethal and a minimum lethal initial infestation in the average guineapig was found to be 2 and 3, respectively, per 100 gm. body-weight. The immunity or enhanced tolerance developed from initial maximum sublethal infestation and from three reinfestations was determined. The tolerance so developed is approximately 50 to 100 per cent. greater than that of uninfested animals and is the result of the initial infestation. No substances deleterious to the larvae were developed in guineapigs from initial infestations or by as many as three reinfestations. In guineapigs

either the extension of a local immunity or the establishing of a systemic immunity by previous infestations was demonstrated. Tests on a small number of animals indicated that no enhanced tolerance is inherited by guineapigs born of infested parents. Other than slight retardation of death, no tolerance to *C. hominivorax* greater than that occurring in normal animals was produced by injection of sterile suspensions of mature tub-reared larvae or of *Proteus chandleri* [cf. 27 4].

BRODY (A. L.). *Natural Foods of Cochliomyia americana, the true Screwworm.*—*J. econ. Ent.* **32** no. 2 pp. 346–347. Menasha, Wis., 1939.

The experiments described were carried out in Georgia during 1937 and 1938 in an attempt to determine the natural food or foods of the adults of *Cochliomyia hominivorax*, Coq. (*americana*, Cush. & Patt.). The foods tested included fresh or slightly rotten fruits and vegetables, either crushed in tap water or sliced without the addition of water, and animal products, such as meat and dung, either with or without a small amount of tap water. The average minimum and maximum length of life of each sex on each food is shown in a table. None of the flies fed on animal products or given water only lived through the oviposition period, which under normal summer conditions is about 9 days; the average maximum length of life for both sexes never exceeded a week. The average maximum for flies fed on vegetable food was in most cases much higher and ranged up to 33 days for females fed on orange, as compared with 30 for those fed on sugar, which was used as a control. Only two of the nine vegetable foods provided insufficient nourishment to enable flies to survive and deposit viable eggs. Usually females fed on the more favourable vegetable foods deposited eggs unless the food was rotten, in which case death occurred within 24–48 hours.

ZIKÁN (J. F.). *Amblyopinus henseli Kolbe, um coleoptero da familia Staphylinidae que parasita mammiferos.* [*A. henseli*, a Staphylinid Beetle parasitising Mammals.]—*Rev. Ent.* **10** fasc. 1 pp. 219–226, 3 figs., 2 refs. Rio de Janeiro, 1939.

A description is given of the morphology of a blood-sucking Staphylinid, *Amblyopinus henseli*, Kolbe, taken on an opossum at Itatiaya, Brazil.

Combate ao *Anopheles gambiae* Giles no Brasil. [The Control of *A. gambiae* in Brazil.]—*Rev. Ent.* **10** fasc. 1 pp. 255–256. Rio de Janeiro; 1939.

Following the introduction of *Anopheles gambiae*, Giles, into the State of Natal, Brazil [cf. R.A.E., B 27 125], a pandemic of malaria occurred there and in Ceará in 1938, 40,000 people being involved, of whom 20,000 died. Dr. Cesar Pinto, who was in charge of control measures, bred *A. gambiae* at a temperature of 21–30°C. [69·8–86°F.]. The egg and pupal stages each lasted 24 hours, and the larval stage 10–12 days. Larvae that were 1–2 days old died when placed in mixtures of equal parts of sea-water and fresh water or of 3 parts sea-water and 7 parts fresh water. Larvae deprived of sunshine died in the fourth instar.

In the young larvae, the leaflets of the abdominal palmate hairs were simple, like those in the larvae of *Nyssorhynchus*; it was only 4 days after hatching that they acquired the bayonet-like appearance peculiar to *A. gambiae* and other Ethiopian species of *Myzomyia*. The arrangement of the clypeal hairs is the sole important character in larvae less than 4 days old.

[ORLOV (E. I.) & LONZINGER (G. K.).] **Орлов (Е. И.) и Лонзингер (Г. К.).** On the Development and Survival of Ticks, *Dermacentor silvarum*, under various natural Conditions. [In Russian.]—*Zool. Zh.* 17 no. 2 pp. 287-302, 6 graphs, 19 refs. Moscow, 1938. (With a Summary in English.)

The investigations described were carried out from 15th May to 20th August 1936 in the Province of Saratov in a deciduous forest situated on the slopes of a ravine and in a pasture in the steppe very much trampled by cattle. Engorged females of *Dermacentor silvarum*, Olen., taken on cattle or pigs, and unfed and engorged larvae and nymphs were confined in wire-gauze cylinders, which were placed in small cavities in the soil corresponding to the natural habitats of the tick and examined at intervals. In the forest, the cavities were made among the roots of trees and covered with fallen foliage, and in the pasture in small heaps of earth. The soil in the pasture was warmer and drier than in the forest, the surface temperature in June-July being higher by 10-15°C. [18-27°F.]. In the pasture, the adult ticks lived for 24-46 days, the oviposition period averaged 15.3 days, and 82.2 per cent. of the ticks laid the normal large number of eggs. In the forest, the corresponding figures were 29.78, 29.5 and 55. The egg stage lasted 15.35 and 35.57 days, respectively. The shorter life of the ticks in the pasture was due chiefly to more rapid and intense oviposition, which is followed by natural death, though the higher temperature and dryness slightly accelerated their death after oviposition was completed. The resistance of the eggs to desiccation was in direct proportion to the size of the egg batches. Mass hatching of the larvae occupied a mean period of 5.7 days in the pasture and 9.4 in the forest. The unfed larvae died sooner in the pasture in June and July, but lived about as long as in the forest in August. Practically all the unfed nymphs in the pasture died within a fortnight, but of those in the forest about 60 per cent. survived for this time, though all died within about 29 days. On the other hand, the metamorphosis of engorged larvae into nymphs and of engorged nymphs into adults required 3-12 and 8-17 days, respectively, in the pasture, and 3-16 and 21-28 days in the forest.

The author concludes that *D. silvarum* is well adapted to the steppe semi-desert zone of the south-east of European Russia, being capable of completing its life-cycle in forests and scrub-land, as well as in the open steppe. Rodents are available as hosts for the larvae and nymphs in both environments.

[MARKOVICH (N. Ya.).] **Маркович (Н. Я.).** La biologie de l'*Anopheles maculipennis* dans le Nord. [In Russian.]—*Med. Parasitol.* 8 no. 1 pp. 89-108, 5 graphs, 3 diagr. Moscow, 1939. (With a Summary in French.)

In the summer of 1937, observations on the bionomics of *Anopheles maculipennis*, Mg., were carried out in the town of Sol'vychegodsk

in the Province of Archangel [cf. R.A.E., B 27 74]. Of 245 batches of eggs laid in June–September, 211 belonged to race *messeae*, Flni., and only 34 to race *maculipennis* (*typicus*). The spring was early, and the mosquitos were leaving their hibernation quarters from about mid-April to the end of May. As a result, the period of emergence of the adults of the first generation was also protracted; the peak was reached between 19th and 23rd June. Mass emergence of the adults of the second generation occurred at the end of July and beginning of August. Females with a developed fat-body were observed from 25th June onwards and were abundant in early August.

The mosquitos concentrated chiefly in animal quarters, which were close to inhabited houses. Thus, during the summer, 3,144 mosquitos were taken in a goat-shed and 5,115 in a cow-shed, as compared with only 5 and 4, respectively, in the adjoining houses. In well-built sheds that offered adequate day-time shelter, the percentage of females with a developed fat-body increased steadily, reaching 80–90 at the beginning of September, whereas they disappeared from sheds with cracks and holes in the walls. Up to September, mosquitos also sheltered in open sheds, where many remained for more than one day and some completed the gonotrophic cycle. Of mosquitos caught in traps placed in the window of a pig-sty, most of those that entered were unfed females, and most of those that made their way out were females that had completed digestion. In August and September, however, mosquitos that entered consisted mainly of females with a developed fat-body and of males. A greater number of fat females left the shelter than entered, which indicates that the fat-body developed at the expense of the blood-meal taken in the sty, or of fluid that accumulated in the crop while the mosquitos were outdoors. Females with a developed fat-body did not feed on blood. The exit of mosquitos from shelters was found to depend chiefly on light and was practically not affected by temperature or by relative humidity, at least within the limits of 53–95 per cent. In June and July, the mass flight took place 30–40 minutes after sunset, in August immediately after it, and in September before it.

The mosquitos were active at temperatures ranging from 10 to 25°C. [50–77°F.] and a humidity of from 50 to 100 per cent. During the very light nights in June, they attacked man at all hours up to 7 a.m., with only a short interval during the darkest period. At the end of August and in September, when most of the females had a developed fat-body and did not take blood, both sexes were very active in the evening, but did not bite. The mosquitos were strongly attracted by domestic animals; precipitin tests on 1,650 individuals showed that 1,556 had fed on animals only, 67 on man only, and 27 on both. Of 940 females examined for malaria parasites between 28th April and 10th September, 4 had oöcysts on the stomach.

[SHMELEVA (Yu. D.) & DUSHEVSKI[†] (Ya. I.).] Шмелева (Ю. Д.) и
Душевский (Я. И.). Peuplement du réservoir d'Ivanjkovo par les
larves d'*Anopheles maculipennis* pendant la première année de son
existence et leur perte à cause d'un abaissement soudain du niveau
de l'eau. [In Russian.]—Med. Parasitol. 8 no. 1 pp. 109–117,
1 graph. Moscow, 1939.

Following the opening of the Moscow-Volga canal in 1937, a survey was undertaken of the large water reservoirs connected with it to

determine their importance as foci of malaria and to work out a method of controlling Anopheline larvae in them. An account of such a survey of a reservoir near the town of Kalinin in 1937 is given. It occupied an area of about $7\frac{1}{2}$ acres in a low-lying part of the Volga valley and consisted chiefly of shallow water with some deeper pools and bays. It was overgrown with floating aquatic vegetation and plankton Lemnids, and larvae of *Anopheles maculipennis*, Mg., were very abundant in it. They were also numerous in shallow pits and a ditch near the reservoir. Systematic counts of adult mosquitos, which belonged to race *messeae*, Flni., and were caught in animal quarters at distances of up to $\frac{1}{2}$ mile from the reservoir, showed that they were most abundant from 15th July to 10th August; a decrease in their numbers after mid-August was partly due to migration to uninhabited hibernation quarters. In August, water from the reservoir had to be drained into the Volga; this lowered the water level by about a foot, and most of the larvae occurring along the shore line were stranded and killed. Larvae survived in depressions, but with a further lowering of the water level by an additional 5 feet all the larvae present in the reservoir were stranded and died, while those in bays and pools, as well as the aquatic vegetation, were carried away by the water that rushed into the Volga. In view of the excellent results obtained, it is suggested that investigations on the maintenance of adequate fluctuations of the water level in the reservoir should be carried out [cf. R.A.E., B 24 131].

[VAINSSTEIN (N. V.)] Вайнштейн (И. В.). Observations sur le comportement des larves d'*Anopheles* dans les parties verdifiées de la surface de l'eau. [In Russian.]—Med. Parasitol. 8 no. 1 pp. 118–122, 2 figs. Moscow, 1939. (With a Summary in French.)

Field observations on the behaviour of Anopheline larvae after oiling were carried out near Astrakhan in water having a temperature of 16–23°C. [60·8–73·4°F.] and covered with vegetation. For this purpose, areas of about 4 sq. m. near the bank were enclosed and divided into three zones of 1–1·5 sq. m. by shields arranged so as to leave an opening 0·5 m. wide between each zone and the next. Crude oil was applied to the whole or half of the surface of the first zone nearest to the bank, at the rate of 30–40 gm. per sq. m. The numbers of larvae present in the three zones were estimated by taking sample dips (3 per sq. m.) before the application of the oil and at intervals of 40–50, 80–100 and 120–150 minutes after it. As the oil film spread, the larvae tried to escape and made their way from the first zone into the others. A table averaging the results of the experiments shows that the number of larvae per sq. m. in the first, second and third zones, respectively, were 13·33, 6·9 and 3·2 before oiling, 6·1, 8·97 and 4 after 40–50 minutes, 3·58, 8·1 and 4·7 after 80–100, and 3, 6·4 and 9·3 after 120–150. The distance and rapidity of migration of the larvae depended directly on the rapidity with which the oil film spread. In calm weather in places overgrown with vegetation, the older larvae moved only 3–4½ ft. in the course of an hour. The slow increase in the numbers of larvae in the third zone indicates that they are driven forward gradually and mechanically by the edge of the oil film. Observations on the effect of the film on drops of thick ink deposited on the water round it showed that as the oil spread, the ink on the surface was driven forward while particles that had sunk a few

millimetres below the surface trailed in the water under the film. This indicates that the oil can drive larvae on the surface mechanically but not those that are submerged. In another experiment, larvae of all instars driven by the film dived repeatedly; those of the third and fourth instars plunged deep and reappeared on the surface further than the edge of the film, whereas most of the younger larvae were unable to move more quickly than the film and, after repeatedly diving and ascending in the treated surface, were eventually killed by the oil.

[MIRONOV (V. S.)] **Миронов (В. С.).** On the Behaviour of the Siberian Forest Tick *Ixodes persulcatus* Schulze. [In Russian.]—*Med. Parasitol.* **8** no. 1 pp. 123–136, 17 graphs, 1 fig., 11 refs. Moscow, 1939. (With a Summary in English.)

A detailed account is given of laboratory observations on the reaction of the adults of *Ixodes persulcatus*, Schulze, to various physical factors, especially light.

[SHUKHAT (I. A.) & REVICH (E. I.)] **Шухат (И. А.) и Ревич (Е. И.).** La technique de la culture des poux au laboratoire pour les travaux expérimentaux sur le typhus exanthématisque. [In Russian.]—*Med. Parasitol.* **8** no. 1 pp. 141–144. Moscow, 1939. (With a Summary in French.)

An account is given of observations on the fertility of the females of *Pediculus humanus*, L. (*vestimenti*, Nitzsch) in which the lice were fed on man twice a day and kept in test tubes at 32°C. [89·6°F.]. Under these conditions, the oviposition period lasted from 3 to 33 days, with a mean of 27, and the maximum number of eggs laid by a female was 158; the lowest, highest, and average numbers of eggs laid in a day were 1, 8 and 3·7, respectively. Thus an average female would lay about 100 eggs in 27 days. Only 59–73 per cent. of the eggs, with a mean of 65, hatched in the laboratory, and only 43–55 per cent. of the nymphs matured, as they are very susceptible to adverse factors and often die during moulting. Of the resulting adults, 3–5 per cent. died before oviposition. Thus only about 27 adult lice can usually be obtained for experiment from the eggs of one female. The egg stage was completed in 6 days, and the 3 nymphal instars in 15.

[ПОКРОВСКИЙ (Н. Н.) & DZHANGIROV (K. G.)] **Покровский (Н. Н.) и Джангиров (К. Г.).** Un essai de mécanisation des mesures anti-larvaires terrestres. [In Russian.]—*Med. Parasitol.* **8** no. 1 pp. 145–146. Moscow, 1939.

In experiments in the Province of Krasnodar (northern Caucasus), oil was successfully applied against Anopheline larvae from a powerful orchard sprayer carried on a motor-boat that travelled at 6 miles per hour. The oil for the sprayer was pumped from a 40 gal. barrel filled with crude oil and standing upright in the boat. Spraying by this method at the rate of 90 lb. oil per acre of surface killed all the larvae in water with floating vegetation or with belts of reeds up to about 10 ft. wide, and 91·7 per cent. in water with belts of reeds 10–20 ft. wide. The width covered by the spray was 8½ ft., an acre was oiled in 10 minutes, and some 45 acres of water surface were treated in one working day. When the dosage was reduced to 72 lb. per acre (by increasing the width of the spray wave to just over 10 ft.), 98–100

per cent. mortality of the larvae was obtained in water with freely floating vegetation, an acre was oiled in 8 minutes and about 55 acres were treated in a day. With the usual method of spraying from the ground, only 5-7½ acres are oiled in a day, and 6 or 7 men are required instead of 3.

[GENDEL'MAN (Tz. A.).] Гендельман (Ц. А.). Sur l'extinction hivernale des femelles de l'*Anopheles maculipennis* restées infécondées. [In Russian.]—*Med. Parasitol.* **8** no. 1 p. 147. Moscow, 1939.

Of hibernating females of *Anopheles maculipennis*, Mg., taken in Dnepropetrovsk (central Ukraine) in November and December 1936 and January, February, March and April 1937, 47·2, 27·5, 7·1, 9·4, 8 and 7·8 per cent., respectively, had empty spermathecae. It thus appears that the majority of the unfertilised females die in the course of the winter.

[KRASIKOVA (V. I.).] Красикова (В. И.). Durée de la conservation des pontes de l'*Anopheles maculipennis* par la méthode Barber. [In Russian.]—*Med. Parasitol.* **8** no. 1 p. 148. Moscow, 1939.

In the experiments described, females of *Anopheles maculipennis*, Mg., were induced to oviposit on small disks of filter paper, and each disk was placed on a strip of moist filter paper, which was inserted into a test tube. A few drops of 2 per cent. formalin were then poured on the strip. The test tube was stopped with cork or cotton wool and sealed with paraffin or other wax, or had a rubber stopper. More formalin had to be added every 8-10 days in the summer, unless a rubber stopper was used, when it lasted for 1½-2 months. In this way, 6,320 batches of eggs were kept in test tubes sealed with paraffin wax for 3 years, and the dorsal pattern was still well preserved in 71·7 per cent. of the eggs at the end of that period.

[REMENNIKOVA (V. M.).] Ременникова (В. М.). Sur les conditions de la première maturation des œufs chez les femelles nouveau-nées de l'*Anopheles maculipennis messeae*. [In Russian.]—*Med. Parasitol.* **8** no. 1 pp. 148-149. Moscow, 1939.

Observations were carried out in June-July 1937 in the south-east of the Province of Archangel on the behaviour of newly emerged females of *Anopheles maculipennis*, Mg., race *meseae*, Flni., which were allowed to feed on malaria patients and were then released in an insectary containing pigs and reservoirs of water [*cf. R.A.E.*, B **27** 74]. When they oviposited, 7 or 8 days later, most of them had taken a second blood-meal and contained fresh blood. This suggests that females that have fed initially on people infected with malaria in a house may remain in the house until they feed again, in which case the development of the malaria parasites in them will be completed much more quickly than in mosquitos resting in ordinary shelters, where the temperature is considerably lower than in houses. As a result, malaria may be transmitted in the spring and at the end of the summer.

[VAL'KH (S. B.).] Вальх (С. Б.). *Anopheles hyrcanus* Pall. dans la région de Voroshilovgrad (Ukraine). [In Russian.]—*Med. Parasitol.* **8** no. 1 p. 150. Moscow, 1939.

In the Ukraine, *Anopheles hyrcanus*, Pall., has been recorded only from the south-west. In June 1938, however, a female of this species

was found in the district of Starobel'sk in eastern Ukraine near a lake formed by floods and densely overgrown with *Lemna trisulca* and reeds. The Anophelines previously found in this district were *A. claviger*, Mg. (*bifurcatus*, auct.), which was locally abundant, and *A. maculipennis*, Mg., which was common. Of the races of the latter, *messeae*, Flni., was predominant, *maculipennis* (*typicus*) was also numerous, and *atroparvus*, van Thiel, was rare.

PAPERS NOTICED BY TITLE ONLY.

- SPENCER (G. J.). **Ectoparasites of Deer in British Columbia** [Hippoboscids and lice on *Odocoileus* spp.].—*Proc. ent. Soc. B.C.* no. 35 pp. 15–19. Victoria, 1939.
- COOLEY (R. A.). **The Genera *Dermacentor* and *Otocentor* (Ixodidae) in the United States with Studies in Variation** [*Otocentor*, gen. n., for *D. nitens*, Neum.]—*Bull. Nat. Inst. Hlth* no. 171, v +89 pp., 30 pls., 8 figs. Washington, D.C., Supdt. Documents, 1938. Price \$1.25
- EXLINE (H.) & HATCH (M. H.). **Note on the Food of the Black Widow Spider** [*Latrodectus mactans*, F., on the San Juan Islands, Washington].—*J. N. Y. ent. Soc.* **42** no. 4 pp. 449–450. New York, N.Y., 1934. [Recd. 1939.]
- PRATT (R. Y.) & HATCH (M. H.). **The Food of the Black Widow Spider** [*Latrodectus mactans*, F.] on Whidby Island, Washington.—*J. N. Y. ent. Soc.* **46** no. 2 pp. 191–193, 4 refs. New York, N.Y., 1938.
- CERQUEIRA (N.). **Sobre *Psorophora lutzi* Theobald, *Psorophora albipes* Theobald e *Psorophora forceps* n. sp. (Dipt. Culicidae)** [descriptions of both sexes from Brazil].—*Rev. Ent.* **10** fasc. 1 pp. 78–85, 14 figs. Rio de Janeiro, 1939.
- SINTON (J. A.). **What Malaria costs India.**—*Hlth Bull.* no. 26 (*Malar. Bur.* no. 13) ii+127 pp., 1 diagr., 9 pp. refs. Delhi, Manager of Publications, 1939. Price 1s. 3d. [Cf. R.A.E., B **24** 167.]
- CHÉDÉCAL (M.). **Contribution à l'étude du comportement trophique des Anophélines, à Hanoi.**—*Ann. Méd. Pharm. colon.* **37** no. 1 pp. 62–66. Paris, 1939. [See R.A.E., B **27** 154.]
- [BEKKER (É.)] Беккер (Э.). **The Mouth Apparatus of the *Anopheles* [*maculipennis*, Mg.] Larva and its Movements in Feeding upon Organisms of the Surface Film of Water. Part I. The Labrum of the Larva and its Functions.** [In Russian.]—*Zool. Zh.* **17** no. 3 pp. 427–440, 12 figs., 1 ref. Moscow, 1938. (With a Summary in English.)
- LAVIER (G.). **La lutte contre les glossines** [a general review].—*Ann. Méd. Pharm. Colon.* **37** no. 1 pp. 27–40. Paris, 1939.
- POPESCU-BARAN (M.). **Présence de larves d'*Hypoderma bovis*, au second stade d'évolution, dans le canal rachidien de la génisse.**—*Bul. Asoc. Med. vet. Rom.* **51** no. 1–2, repr. 3 pp. Bucarest, 1939. [Cf. R.A.E., B **27** 192.]
- [MIRONOV (V. S.)] Миронов (В. С.). **Ovine Encephalomyelitis (Louping-ill) and its Importance for the Comprehension of certain Diseases of Man (Review of Literature.)** [In Russian.]—*Med. Parasitol.* **8** no. 1 pp. 137–140, 24 refs. Moscow, 1939.

**Report of the Proceedings of the Third Annual Conference of the B.N.
Railway Malaria Inspectors held on the 21st February, 1938 at
Khargpur.—4 + 88 pp. Calcutta [1939].**

The text is given of the following papers read at the third annual conference of the Bengal-Nagpur Railway Malaria Inspectors' Association, which are chiefly of local interest: Malaria on the Chilka Lake, by R. Senior White (pp. 4-9); Man-made Malaria, by A. K. Adlikari (pp. 10-16); Yellow Fever Menace to India, by S. K. Banerji (pp. 20-22); Financial Aspects of Species Control, by M. K. V. Venkat Rao (pp. 23-26); Some Impressions of Malaria Control on Railway Constructions, by W. F. Fox (pp. 29-33); Resting Habits of Adult Mosquitos, by M. Lazarus (pp. 34-36); Further Observations on Anophelines Breeding in Tanks and Rice Fields at Khurda Road, by V. Venkat Rao (pp. 38-53); *Anopheles* Species Succession in Paddy Fields in Jeypore Hills, by R. S. Mondal (pp. 54-65); Breeding Habits of some Anophelines as studied in Species Control, by P. V. Joga Rao (pp. 69-72); Species Control in Prevention of Malaria with a few Observations on the Bionomics of *A. funestus*, by D. K. Das (pp. 73-80), in which the author uses the name *funestus* for *Anopheles fluviatilis*, James, *A. minimus*, Theo., and *A. varuna*, Iyen.; and Anophelines Breeding in the Sandel River at Langigarh Road (964' above Sea Level), by R. S. Mondal (pp. 80-84). In almost all cases the papers are followed by discussions.

FARINAUD (E. M.). **Le paludisme à Poulo-Condore.**—*Ann. Inst. Pasteur* **62** no. 5 pp. 540-570, 2 figs. Paris, 1939.

In the course of this account of malaria and its control on the island of Poulo-Condore, the author discusses the Anophelines that occur there and the transmission of the disease by unusual vectors. Much of the information on this subject is similar to that already noticed in a paper [*R.A.E.*, B **26** 203] in which Poulo-Condore was the first of the three localities mentioned. He indicates the difficulties of carrying out drainage and oiling, owing to local topography and economy, and the slowness of filling, owing especially to the lack of sufficient labour, gives a brief account of the measures that are being undertaken, and points out that since these cannot give immediate results, it has been necessary to have recourse to medical prophylaxis.

GIBBINS (E. G.). **Simuliidae.**—*Ruwenzori Exped. 1934-5* **1** no. 2 pp. 11-27, 1 pl., 12 figs., 6 refs. London, Brit. Mus. (Nat. Hist.), 1939.

EDWARDS (F. W.) & GIBBINS (E. G.). **Mosquitoes.**—*T.c.* no. 3 pp. 29-33, 1 pl.

MACFIE (J. W. S.). **Ceratopogonidae.**—*T.c.* no. 5 pp. 81-107, 2 pls., 12 figs.

VAN EMDEN (F.). **Muscidae : Museinae and Stomoxydinae.**—*Op. cit.* **2** no. 3 pp. 49-89, 2 pls., 8 figs.

JORDAN (K.). **Siphonaptera.**—*Op. cit.* **3** no. 2 pp. 41-49, 1 pl., 6 figs., 10 refs.

These systematic papers deal mainly with insects taken in Uganda and Kenya in the course of the Ruwenzori Expedition of 1934-35.

The Simuliids taken in the Namwamba Valley of Ruwenzori, Uganda, during December 1934, which are dealt with in some detail, were *Simulium kauntzeum*, Gibbins, *S. bisnovem*, Gibbins [cf. R.A.E., B 26 157], *S. debegene*, De Meillon, *S. lepidum*, De Meillon, and *S. dentulosum*, Roub. Other species found in this region are *S. duodecimum*, Gibbins, *S. damnosum*, Theo., and *S. cervicornutum*, Pomeroy, which were taken in the course of the Expedition, and *S. taylori*, Gibbins [*loc. cit.*], which was taken in 1931.

The only Anopheline found among the mosquitos of the bamboo zones on the Birunga Mountains and Ruwenzori was *Anopheles garnhami*, Edw., which was taken at an altitude of 8,000 ft. in the Birunga Mountains; this species was also taken in Kenya on Mount Kinangop at about the same altitude and on Mount Elgon at about 11,000 ft. The Anophelines taken on the foothills of Ruwenzori were *A. implexus*, Theo., *A. gambiae*, Giles, *A. marshalli* var. *gibbinsi*, Evans, and *A. demeilloni*, Evans.

The paper on Ceratopogonids, which includes descriptions of new species from Uganda and Kenya, has an appendix by B. De Meillon in which he describes two new species of *Ceratopogon* from Zululand and erects a new subgenus for them.

The paper on Muscids also includes the results of a study of collections from other parts of the Ethiopian Region, and that on fleas deals with 14 species from Uganda and Kenya and includes fuller descriptions of 4 described as new in a recent paper [26 40].

AYROZA GALVÃO (A. L.) & DO AMARAL (A. D. F.). *Sobre um novo anofelino de Campos do Jordão, estado de São Paulo, Anopheles (Nyssorhynchus) lanei n. sp. (Diptera, Culicidae).* [On a new Anopheline, *A. lanei*, sp. n., from Campos do Jordão, State of São Paulo.]—Rev. Biol. Hyg. 9 pt. 1 pp. 8–16, 4 pls., 10 refs. São Paulo, 1938. (With a Summary in English.)

AYROZA GALVÃO (A. L.). *Observações sobre algumas espécies do subgenero Nyssorhynchus, com especial referência à morfologia dos ovos.* [Observations on some Species of the Subgenus *Nyssorhynchus*, with special Reference to the Morphology of the Eggs.]—T.c. pp. 51–60, 6 pls., 13 refs. (With a Summary in English.)

AYROZA GALVÃO (A. L.) & PEREIRA BARRETTO (M.). *Contribuição ao conhecimento dos primeiros estádios dos anofelinos de São Paulo.* [A Contribution to the Knowledge of the first Stages of the Anophelines of São Paulo.]—T.c. pt. 2 pp. 110–115, 6 pls., 7 refs. (With a Summary in English.)

AYROZA GALVÃO (A. L.) & PEREIRA BARRETTO (M.). *Observações sobre o Anopheles albitalis Arribálzaga, 1878, e A. triannulatus (Neiva & Pinto, 1922) de São Paulo.* [Observations on *A. albitalis*, Arrib., and *A. triannulatus*, Neiva & Pinto, of São Paulo.]—T.c. pp. 144–157, 2 pls., 24 refs. (With a Summary in English.)

In the first paper, descriptions are given of all stages of *Anopheles (Nyssorhynchus) lanei*, sp. n., from a locality in the state of São Paulo, Brazil, where larvae and adults were taken at an altitude of about 5,200 ft. The larvae were found in permanent collections of clear water; the adults are zoophilous, and were not observed in dwellings about 50 yards from the breeding places. The species belongs to the

series of *A. argyritarsis*, R.-D., and characters of the adults, larva and egg are given distinguishing it from other members of the series.

In the second paper, descriptions are given of four types of the egg of *A. strodei*, Root, from São Paulo, constant differences between the eggs of *A. oswaldoi* var. *oswaldoi*, Peryassú, and *A. oswaldoi* var. *noroestensis*, Galvão & Lane [R.A.E., B 27 13], and characters of the larvae, pupae and adults of these varieties.

In the third paper, the authors describe four types of the egg of *A. darlingi* var. *paulistensis*, Galvão, Lane & Corrêa [26 55], the egg of *A. argyritarsis*, two further forms of the egg of *A. strodei*, Root, one of which corresponded to one of the types observed by Rozeboom [26 98], and the egg and first-instar larva of *Chagasia fajardoi*, Lutz.

In the fourth paper are recorded observations on the morphology of the adults of *A. albitalis*, Arrib., and *A. triannulatus*, Neiva & Pinto, in São Paulo. *A. albitalis* belongs to the *argyritarsis* series, and a key is given to the females of this series in São Paulo. In a recent publication, C. Pinto considered *A. cuyabensis*, Neiva & Pinto, *A. bachmanni*, Petrocchi, *A. davisi*, Paterson & Shannon, and *A. perezi*, Shannon & Del Ponte, to be synonyms of *A. triannulatus*, and the authors give reasons for accepting this view. Two types of the egg of *A. triannulatus* are described.

AYROZA GALVÃO (A. I.). Observações sobre o ciclo evolutivo do Anopheles oswaldoi Peryassú, 1922. [Observations on the Cycle of Development of *A. oswaldoi*.]—Rev. Biol. Hyg. 9 pt. 2 pp. 101-103, 7 refs. São Paulo, 1938. (With a Summary in English.)

In laboratory studies on the bionomics of *Anopheles oswaldoi* var. *noroestensis*, Galvão & Lane [R.A.E., B 27 13] and *A. oswaldoi* var. *oswaldoi*, Peryassú, reared from adults taken at Novo Oriente in north-western São Paulo, Brazil, the egg, larval and pupal stages lasted 2 and 1, 9 and 9, and 2 and 2 days, respectively. The laboratory temperatures varied from 24.5 to 27.5°C. (76.1 to 81.5°F.), and the medium used consisted of grasses from Anopheline breeding places macerated in tap water, with the addition of Flcishmann's yeast.

PEREIRA BARRETO (M.). Observações sobre a ecologia do *A. darlingi* Root 1926, var. *paulistensis* Galvão, Lane & Correia 1937. [Observations on the Ecology of *A. darlingi* var. *paulistensis*.]—Rev. Biol. Hyg. 9 pt. 2 pp. 116-132, 2 pls., 16 refs. São Paulo, 1938. (With a Summary in English.)

Very little work has been done on the breeding places of *Anopheles darlingi*, Root, which is considered on epidemiological evidence to be the chief vector of malaria in the interior of São Paulo, as it is in certain other regions of Brazil [R.A.E., B 22 9, etc.]. In São Paulo it is represented by var. *paulistensis*, Galvão, Lane & Corrêa [26 55], and this may account for the unsuccessful examinations there of breeding places characteristic of the typical form of *A. darlingi*.

In October December 1938, the author carried out observations on breeding places of var. *paulistensis* at Fazenda Santa Elsa, in the municipality of Palmeiras. This locality is at an altitude of about 2,000 ft., with a warm, rainy climate, and has about 100 inhabitants in groups of houses, nearly all with stables, pig-sties and poultry sheds.

Malaria had been present there since 1934. In July 1938, seven of the 102 persons examined were infected with *Plasmodium falciparum* and one with *P. vivax*. Of 18 Anophelines caught in dwellings in July, 14 were *A. darlingi* var. *paulistensis*, 3 *A. albitalis*, Arrib., and 1 *A. argyritarsis*, R.-D. The percentages of mosquitos captured by means of horse-bait were 82·62 for *A. d. paulistensis*, 8·69 for *A. strodei*, Root, and 8·69 for *A. argyritarsis*.

In the periods 19th October–10th November and 17th November–3rd December, var. *paulistensis* represented 82 per cent. of the 156 mosquitos caught in dwellings, and 67·75 per cent. of the 400 taken in a Magooon trap baited with a horse [cf. 23 302]. It also represented 62·5 per cent. of 644 larvae taken in side bays and along the edges of water above a dam, and 0·56 per cent. of 356 larvae taken in ditches, shallow pools and small swamps above and below the dam. The water in which the larvae of var. *paulistensis* were abundant was deep, clear, and without current, and the banks were of red earth. It was shaded by cypresses (*Cupressus glauca*), the branches of which reached to the water and formed still pools. There was very little vegetation in these, and the larvae of var. *paulistensis* were found among débris from the trees. The temperature of the water in these pools varied from 23 to 27°C. [73·4–80·6°F.] and was much more constant than in other parts of the dam. The water was slightly alkaline, its pH varied from 7·1 to 7·3, and it contained little organic matter and was poor in chlorides. The scanty vegetation in the pools consisted mainly of *Echinodorus paniculatus* and species of *Mayaca* and *Hygrophila*. Few algae, few predacious insects and many fish were present.

AYROZA GALVÃO (A. L.). *Sobre a infecção experimental do Anopheles strodei pelo Plasmodium vivax*. [On the experimental Infection of *A. strodei* with *P. vivax*.]—*Rev. Biol. Hyg.* 9 pt. 2 pp. 133–134, 2 pls., 3 refs. São Paulo, 1938. (With a Summary in English.)

Reference is made to previous experimental infection of *Anopheles strodei*, Root, with malaria (*Plasmodium vivax*) [R.A.E., B 26 20], and it is stated that in recent work by R. Corrêa, 2 of 174 females of this Anopheline taken in houses in Marilia, São Paulo, contained oöcysts in the stomach. In further experiments by the author, four females of *A. strodei* were fed on a carrier of gametocytes of *P. vivax* and kept at 19–24°C. [66·2–75·2°F.] and 67–88 per cent. relative humidity for 19 days. They were then dissected, and two contained numerous mature oöcysts in the stomach and sporozoites in the salivary glands. Of five females of *A. albitalis*, Arrib., similarly treated and kept for 10–19 days, none became infected.

ADAMSON (A. M.). *Observations on Biting Sandflies (Ceratopogonidae) in Trinidad, British West Indies*.—*Trop. Agriculture* 16 no. 4 pp. 79–81, 13 refs. Trinidad, 1939.

Notes are given on the distribution, prevalence, biting habits and probable breeding places of blood-sucking Ceratopogonids collected in Trinidad since 1933. These comprise, in the approximate order of their importance as pests, *Culicoides amazonius*, Macfie, *C. guttatus* var. *diabolicus*, Hoffman, *C. stellifer*, Coq., *C. furens*, Poey, *Holoconops* (*Leptoconops*) *becquaerti*, Kieffer (*hondurensis*, Hoffman), *C. guttatus*,

Coq., *C. debilipalpis*, Lutz, and *C. pusillus*, Lutz. Macfie considers that *C. trinidadensis*, Hoffman [cf. R.A.E., B 23 169] is probably *C. guttatus* var. *diabolicus* [*trinidadensis* has page priority over *diabolicus*.—Ed.].

GIGLIOLI (G.). Malaria in British Guiana. Parts I-III.—*Agric. J. Brit. Guiana* 9 nos. 2-4 pp. 75-81, 135-146, 197-206, 11 pls., 3 figs. Georgetown, 1938. **Parts IV-V.—***Op. cit.* 10 no. 1 pp. 4-9, 9-12, 7 pls. (1 fldg.). 1939.

In the first part of the paper, the author discusses the Anophelines of British Guiana and points out that of over 20,000 adults examined since 1934, *Anopheles tarsimaculatus*, Goeldi, *A. albitalis*, Arrib., and *A. darlingi*, Root, comprised 99.9 per cent. and that all larvae and pupae collected belonged to these species. The last two species have previously been confused under the name *A. argyritarsis*, R.-D. [cf. R.A.E., B 10 33; 17 192], which has not yet been found in the Colony. These three species are widely distributed and very abundant. Notes are given on their distinguishing characters, habits, distribution and seasonal prevalence.

In the second part is given the evidence that has been collected concerning the relative importance of each of the above-mentioned species in the transmission of malaria, which is present throughout the Colony, but varies greatly in intensity in different localities. *A. darlingi* was the only species of which the geographical and topographical distribution coincided with that of malaria, it constituted 99.1 per cent. of 15,035 Anophelines taken in houses, and it appears to be anthropophilous, whereas the other two species prefer to feed on animals. Moreover, *A. tarsimaculatus* and *A. albitalis* are prevalent in localities that are usually free from endemic malaria. *A. darlingi* was always found to be present wherever malaria epidemics occurred, and their severity was directly proportionate to its abundance.

The third part deals in detail with the breeding places of *A. darlingi*, both inland and on the coast, and with the influence of atmospheric humidity and air movement on the adults, which are very susceptible to desiccation. Many of the favourable breeding places on the coast are man-made and are essential factors in the cultivation of sugar and rice. These surface waters (irrigation canals, flooded fields, etc.) are permanent and do not depend on seasonal factors such as rainfall, and both adults and larvae of *A. darlingi* have been found throughout the year, although the intensity of breeding varies with the season. In the interior they are found throughout the year only in the vicinity of the fresh-water seepage swamps, as there are no other suitable permanent breeding sites. These findings probably account for the fact that the seasonal incidence of the disease is very much less clearly defined on the parts of the coast subject to endemic malaria than in the interior. Findings in both the coastal and interior regions indicate that breeding is restricted to certain types of surface water, and that water collections of considerable size are preferred. It is believed that hydrogen-ion concentration and salinity of water and soils are two of the limiting factors. In the interior, a large proportion of the surface waters are strongly acid and are not considered to be dangerous from a malaria point of view; moreover, breeding has been successfully controlled in certain cases by allowing tidal influx of acid river and creek waters.

In the fourth part, the author discusses the distribution of malaria in the coastal region, its relation to topography and agriculture, and the genesis of epidemics. The unevenness of its distribution is considered to be due to variations in the factors influencing the breeding of *A. darlingi*. The seasonal distribution of rainfall appears to be responsible for epidemics of malaria. Heavy rains during the late autumn and winter months, when the temperature is low and the trade winds are strongest, are never associated with an increase in the numbers of Anophelines, whereas failure of rains at this time favours the survival of large numbers of *A. darlingi* and is often the prelude to an epidemic. The spring-summer rains, which usually begin in May and coincide with the period of highest temperature and the fall of the trade winds, always give rise to active breeding. If they are steady and continue throughout July and August, and possibly into September, especially if the temperature is unusually high, the breeding of *A. darlingi* becomes both extensive and intensive and the incidence of malaria rises rapidly. Moreover, heavy and persistent rains may so change the physico-chemical properties of surface waters that are normally unsuitable for breeding as to render them attractive. Observations in the interior indicate that the interval between the onset of the rains and the rise in the incidence of malaria is in inverse proportion to the temperature. Increased nocturnal humidity, which accompanies persistent rains, favours the survival and flight of *A. darlingi* and thus increases its activity and dispersion. The formation by rain of suitable breeding places near houses also favours transmission.

In the fifth part, an attempt is made to assess the injury caused by malaria to the population of the country.

PHILLIPS (J. H.). **Studies on the Transmission of *Dirofilaria immitis* in Massachusetts.**—*Amer. J. Hyg.* **29** (D) no. 3 pp. 121-129, 4 figs., 5 refs. Lancaster, Pa., 1939.

The observations described were carried out at a range of kennels in Massachusetts, where 4 out of the 32 dogs harboured *Filaria (Dirofilaria) immitis*, in order to obtain information on the means of transmission of the parasite [cf. R.A.E., B **27** 105]. Examinations were made of mosquitos and blood-sucking flies seen in and near the kennels or caught while feeding on an infected dog and dissected at intervals thereafter, and of adult mosquitos reared from larvae collected in the vicinity and subsequently allowed to feed on an infected dog. Early in the investigation, 21 examples of *Ctenocephalides canis*, Curt., taken on an infected dog were dissected but showed no evidence of infestation; it was, therefore, concluded that fleas could be of no great importance as intermediate hosts. Several examples of *Stomoxys* and *Tabanus* taken in the neighbourhood also proved to be uninfested. The development of the filarial larvae to the infective stage was observed in six species of mosquitos taken while feeding on an infected dog. The species were *Anopheles quadrimaculatus*, Say, *A. punctipennis*, Say, *Aëdes excrucians*, Wlk., *A. cinereus*, Mg., *A. triseriatus*, Say, and *Culex territans*, Wlk. Sausage-shaped larvae were seen in the malpighian tubes of the first three when they were caught in unscreened kennels. After the infected dogs had been removed, mosquitos caught in or near the kennels were free from the parasite. Notes are given on the

bionomics and abundance of each of the six species and on the development of the parasites in them. Experiments with three of the species indicated that these insects do not develop immunity to re-infection. Eighteen examples of *S. calcitrans*, L., collected while feeding on an infected dog all died within 6 days of capture; although they had ingested microfilariae, the ability of this fly to act as a vector is uncertain.

CAUSEY (O. R.). The Development of Frog Filaria Larvae, *Foleyella ranae*, in *Aedes* and *Culex* Mosquitoes.—*Amer. J. Hyg.* 29 (D) no. 3 pp. 131–132, 2 refs. Lancaster, Pa, 1939.

Dissection of examples of *Aedes aegypti*, L., and *Culex pipiens*, L., at intervals up to the 18th day after they had fed on a frog, *Rana clamitans*, heavily infected with *Foleyella ranae*, revealed mature larvae in the head, thorax and abdomen of both species.

COGGESHALL (L. T.). The Transmission of Lymphocytic Choriomeningitis by Mosquitoes.—*Science* 89 no. 2318 pp. 515–516. New York, 1939.

During 1938, a highly virulent spontaneous infection occurred among monkeys (*Macacus rhesus*) that were being used in New York for the study of experimental malaria. Eleven monkeys died in a week, and the causal agent was identified as the virus of lymphocytic choriomeningitis, a disease that attacks man and animals, but of which the normal mode of transmission is unknown. As the virus was found to be present in high concentrations in the circulating blood of some experimental animals, investigations were made on the possibility of an insect vector being involved.

In the initial experiment, a guineapig was inoculated subcutaneously with 1·0 cc. of a 1 : 10 dilution of frozen and desiccated blood from one of the monkeys that had died 6 months previously. On the 7th day, normal females of *Aedes aegypti*, L., were allowed to feed on it. Five days later, 7 of these were allowed to bite a normal guineapig, and were then finely ground with saline and injected into another guineapig. The animal that received the injection died on the 7th day, and the one that was bitten died on the 8th day. Before it died, however, further females of *A. aegypti* were allowed to feed on it, and they also produced a fatal infection when 6 days later 15 of them were permitted to bite a normal guineapig.

Other tests showed that the mosquitos can transmit the virus as early as the 4th day and at least as late as the 15th day after feeding on an infected animal. Death has occurred between the 8th and 18th day following the bite of infected mosquitos, while guineapigs inoculated with a suspension of the same mosquitos usually died 24–48 hours earlier.

The study is being extended to include other hosts and vectors.

GJULLIN (C. M.), YATES (W. W.) & STAGE (H. H.). The Effect of certain Chemicals on the Hatching of Mosquito Eggs.—*Science* 89 no. 2319 pp. 539–540. New York, 1939.

The eggs of *Aedes vexans*, Mg., and *A. lateralis*, Mg. (*aldrichi*, D. & K.) are deposited on the soil among fallen leaves and grass of cottonwood flats on the Columbia River and hatch readily when these are flooded. Only 2 per cent., however, hatched when they were flooded in the laboratory with tap-water or with water from the river. In

experiments, infusions of dry or green cottonwood leaves, willow leaves and grass gave larger hatches than either tap or river water alone. The eggs of *A. dorsalis*, Mg., also required the stimulus provided by leaves and grass. The substances causing the stimulus were found to include six amino acids.

ROMAN (E.) & NÉTIEN (G.). Action physiologique sur les larves de moustiques de *Derris elliptica* Benth.—Bull. Soc. linn. Lyon 8 no. 3 pp. 74-79. Lyons, 1939.

The following is based on the authors' summary of laboratory experiments, carried out at Lyons in 1937-38, on the effects of powdered *Derris elliptica*, stated to contain 50 per cent. rotenone, and a commercial rotenone powder on larvae of *Anopheles maculipennis*, Mg., and larvae and pupae of *Culex pipiens*, L., taken in nature: About 2 mg. of either powder per litre of water killed the larvae of *Anopheles* in less than 3 days when scattered on the surface, but 10 mg. per litre was ineffective when the powders were scattered on the bottom of the vessel. The powders were only slightly toxic to the larvae of *Culex*, either on the surface or at the bottom, and were quite ineffective against the pupae. These results are discussed, and it is concluded that rotenone acts on mosquito larvae chiefly as a stomach poison.

SINTON (J. A.) & SHUTE (P. G.). Spirochaetal Infections of Mosquitoes.—J. trop. Med. Hyg. 42 no. 9 pp. 125-126, 1 fig., 12 refs. London, 1939.

The authors record the finding of large numbers of a spirochaete resembling *Spirochaeta culicis* in the salivary glands of a single female of *Anopheles maculipennis*, Mg., race *atroparvus*, van Thiel, which was one of a batch caught in a state of semi-hibernation on 17th October 1937 in an outhouse used to house rabbits on a farm in the estuary of the Thames. On 29th October, the batch was fed on a patient infected with malaria (*Plasmodium vivax*) and placed in a warm incubation room (temperature about 75°F.). Sporozoites were found in the glands on 8th November. On 10th November, the mosquitos were transferred to an outhouse in which the temperature varied from 32 to about 60°F. and given an opportunity of feeding on a rabbit about once a week. The infectivity of the batch was tested periodically throughout the winter, in many cases by crushing infected salivary glands in Locke's fluid and injecting the suspension of sporozoites intravenously into a susceptible patient. On 6th April, the glands of two infected mosquitos were injected, and it was in the crushed remains of the glands of one of these that spirochaetes were found as well as sporozoites. The patient developed no signs of infection with either parasite during a period of about a year. The spirochaete is described. The possibility that it was obtained from the rabbits cannot be excluded, though no evidence of infection with spirochaetes was observed in them.

AZIZ (M.). The Water - Paris Green Mixture in Anopheline Control in the Tilliria Area, Cyprus.—Med. Dep. Papers Govt. Cyprus no. 5, 16 pp., 10 figs., 1 ref. Nicosia, 1939. Price 1s.

An account is given of a method of controlling Anopheline larvae that has proved very satisfactory in Cyprus, in which Paris green is mixed with water instead of kerosene [cf. R.A.E., B 24 289; 26

63] and sprayed on the breeding places. The advantages of this method over dusting with a mixture of Paris green and a dust carrier (1 : 100) [cf. 26 63] are that much less of the poison is required, no time or labour is wasted finding and transporting suitable dust, and the danger of arsenical poisoning of the workers is considerably reduced.

CAMBOURNAC (F. J. C.). A Method for determining the Larval Anopheles Population and its Distribution in Rice Fields and other Breeding Places.—*Riv. Malaria.* 18 (1) fasc. 1 pp. 17-22, 3 figs. Rome, 1939. (With a Summary in Italian.)

The author describes a method for determining the numbers of Anopheline larvae present in natural breeding places that has proved satisfactory in the rice-fields at Aguas-de-Moura, Portugal, where *Anopheles maculipennis*, Mg., race *atroparvus*, van Thiel, is the only Anopheline [cf. R.A.E., B 26 76].

The water in the rice-fields is about 10 cm. deep. A plot is divided into one-metre squares by twine attached to pegs at the edges. A bottomless rectangular tin 25 cm. high with sides of 25 and 40 cm. is placed in the centre of one of the squares and the total number of larvae inside the tin is counted. Since the water surface delimited by the tin is 0·1 sq. m. the number of larvae per square metre is easily determined. The exact procedure used in counting the larvae in the tin is described. It took 3 observers approximately 12 hours to make the counts in 184 squares. A comparison of totals based on counts in every square and in alternate squares showed a difference of only 1 per cent., and the second method was, therefore, adopted to save time.

Larvae were found throughout the plot and not merely at the edges. Differences in density could be correlated with the presence of *Lemna*, which limits the number of larvae, and filamentous algae, especially *Spirogyra*, which are used by the larvae for food and protection. The results of the three counts made in June, July and August, giving the numbers of larvae in each instar and the numbers of pupae, are shown in a table, and the seasonal prevalence is discussed.

COLLIGNON (E.). Observations sur les anophèles et sur certains culicidés d'Algérie (département d'Alger, 1938).—*Arch. Inst. Pasteur Algérie* 17 no. 1 pp. 135-138, 1 pl., 1 fig., 1 ref. Algiers, 1939.

An account is given of the effect of weather conditions and of irrigation schemes on the abundance of Anophelines in the Department of Algiers in 1938 [cf. R.A.E., B 27 33], based on data obtained in the course of routine surveys of breeding places and of day-time resting places of adults. The breeding places recently produced by man include a canal that has been disused since the tunnel taking the waters of Lake Halloula directly to the sea was opened in 1935 [cf. 27 34]. It has been filled in places, and now forms a series of ponds in which water persists throughout the year.

SERGENT (Et.). Du cannibalisme des gambouses et d'un moyen d'y rémédier.—*Arch. Inst. Pasteur Algérie* 17 no. 1 pp. 139-142, 2 figs. Algiers, 1939.

Fish of the genus *Gambusia* are very voracious and if, when they are being used for the control of Anopheline larvae, they are placed in an

insufficient volume of water, they devour their own young. To obviate this, the author has evolved a cage to contain the gravid females that is made of wire netting with a mesh sufficiently large to allow the escape of the fry and of the males. The cage is kept on the bottom and marked by a floating cork attached to a string. In experiments, the number of fish present at the end of a month in two cement basins of equal size was always greater in the one in which the females were caged.

PARROT (L.) & MARTIN (R.). Notes sur les phlébotomes. XVIII.
Autres phlébotomes d'Ethiopie.—*Arch. Inst. Pasteur Algérie* **17**
 no. 1 pp. 143–156, 12 figs., 7 refs. Algiers, 1939.

Additional species of *Phlebotomus* collected in Abyssinia [cf. *R.A.E.*, B **27** 34] in 1937 and 1938 comprised *P. longipes*, sp. n., and *P. vagus*, sp. n., which are described from both sexes, *P. subtilis*, sp. n., and *P. viator*, sp. n., which are described from males only, and *P. squamipleuris* var. *inermis*, Theo., and *P. congolensis*, Beq. & Walr., neither of which has previously been taken in Abyssinia.

CRAWFORD (R.). Some Anopheline Pupae of Malaya with a Note on Pupal Structure.—Med. Svo, 110 pp., 27 figs., 7 refs. Singapore, Govt S.S. & Malar. adv. Bd F.M.S., 1938.

This booklet includes an account of the structure of an Anopheline pupa, and descriptions of the pupae of 16 Malayan Anophelines (including those of the commoner species) and of the characteristics of the groups into which they may be classified [cf. *R.A.E.*, B **22** 177; **24** 99].

BONNE-WEPSTER (J.) & BRUG (S. L.). Larven van Nederlandsch-Indische Culicinen.—*Geneesk. Tijdschr. Ned.-Ind.* **79** pt. 20 pp. 1218–1279, 50 figs., 4 pls: Batavia, 1939.

This paper is complementary to a guide to the adults of the more important Culicine mosquitos of the Netherlands Indies [*R.A.E.*, B **25** 231] and comprises descriptions of the larvae, together with a key and notes on breeding places, collection and the preparation of specimens. The larvae of some of the adults dealt with in the guide are unknown, and larvae of some additional species are included to prevent misidentification.

CROOK (R. L.). Some Notes on Malaria in Szechwan.—*Chin. med. J.* **55** no. 5 pp. 465–478, 1 map, 1 chart, 13 refs. Peking, 1939.

In the course of this report of a study on the prevalence of malaria in Szechwan, China, the author gives brief notes on the distribution, breeding places and seasonal prevalence of *Anopheles hyrcanus* var. *sinensis*, Wied., *A. pattoni*, Chr., *A. minimus*, Theo., *A. gigas* var. *baileyi*, Edw., and *A. lindsayi* var. *plecana*, Koidz., the five species of Anophelines that have been found in the Province. No dissections of mosquitos were undertaken, but the first species undoubtedly plays an important part in the transmission of the disease. Indirect evidence indicates, however, that *A. pattoni* and particularly *A. minimus* are probably of greater importance, since whenever and wherever they occur in large numbers, malaria is present and frequently

hyperendemic. No definite conclusions could be drawn regarding the relation of rainfall to the incidence of malaria. The torrential rains of summer and early September effectively flushed out most of the breeding places of *A. minimus* and *A. pattoni*, but after the rains they increased rapidly and may cause the high incidence of malaria that occurs in late September and October.

A list of the other species of mosquitos collected in Szechwan is given in an appendix.

YANG (Y. N.), LANDAUER (E.), KOO (C. K.) & LIN (P. C.). **Plague Work in Fukien, China. December 1935 to November 1936.**—*Chin. med. J.* **55** nos. 1-5 pp. 55-73, 162-173, 262-275, 383-390, 479-487, 24 figs. Peking, 1939.

Only the last section of this paper (pp. 479-487) is concerned with fleas. The species collected from rats and a few shrews trapped at Lungyen between December 1935 and November 1936 were *Xenopsylla cheopis*, Roths., *Leptopsylla segnis*, Schönh. (*musculi*, Dug.), *Ceratophyllus (Monopsyllus) anisus*, Roths., *C. (Nosopsyllus) nicanus*, Jord., *Pulex irritans*, L., and *Ctenocephalides canis*, Curt. Only 3 and 1 examples, respectively, of the last two species were taken, and the numbers of *C. anisus* and *C. nicanus* were also too small for them to be involved in the transmission of plague. *L. segnis* reached its maximum abundance at a period when the incidence of human plague is at its lowest and was almost entirely absent during the plague season (June-August). Thus *X. cheopis* is the only possible vector at Lungyen. The rats taken, in order of abundance, were *Mus (Rattus) norvegicus*, *M. (R.) ratus alexandrinus* and *M. r. ratus*. Tables are given showing the numbers and indices of the four chief species of fleas for each month, the total flea index and the indices for *X. cheopis* and *L. segnis* on each of the three rats and the shrews, and meteorological data for the period. It is concluded that the degree of infestation of rats is in direct proportion to the amount of harbourage available for them and that those inhabiting houses usually carry more fleas than wild ones.

Saturation deficiency remains below 7.7 mm. (0.3 in.), the critical point for *X. cheopis* [cf. R.A.E., B **18** 121], throughout the year, so that humidity is favourable for breeding in all months with the possible exception of July (7.6 mm.) and October (7.5 mm.); thus the seasonal variation in the incidence of this flea is little influenced by humidity. Rainfall does not appear to have much influence, but temperature seems to be a decisive factor. In India it was found that the optimum temperature ranged from 68 to 80°F. [cf. loc. cit.] and, allowing for a time lag of 3 weeks between the flea indices and the related temperatures, the figures obtained in Lungyen agree surprisingly well with similar data collected in India. In April the temperature rose for the first time to within the favourable range, and a month later the *cheopis* index for the first time considerably exceeded 1. During the following months, the temperature as well as the *cheopis* index continued to rise steadily on almost parallel lines. In July the upper limit of favourable temperature was slightly exceeded and the critical humidity was reached, and in August there was a prompt drop in the flea index. The subsequent decrease in temperature and saturation deficiency caused a new rise in the index. Though the temperature continued to fall in September, the saturation deficiency again approached the

critical limit (7.2 mm.), and a second sharp drop in the flea index occurred in October. In the following month the agreement was not so close, as there was a rise in the flea index in November that was not preceded by a rise in the humidity, though the temperature remained favourable. At Lungyen, *L. segnis* appears to be prevalent in the autumn and spring, its optimum temperature range being 15–20°C. [59–68°F.]. Possibly it tolerates a higher saturation deficiency than *X. cheopis*, as it reappears in autumn at a time when the temperature is still about 25°C. [77°F.] but the air is comparatively dry.

The results of trapping rats between December 1935 and November 1936 indicate that the house rat, *M. r. ratus*, was completely eradicated during the year. Although the plague epizootic that occurred among rats was known not to be limited to this species, it is the one that, under local conditions, plays the most important part in the transmission of the disease to man. Its general and its *cheopis* indices are higher than those of the other local species, and, during an epizootic, its infected fleas are released in the immediate neighbourhood of man and are therefore more likely to transmit infection than those of rats less closely associated.

ESKEY (C. R.). **Fleas as Vectors of Plague.**—*Amer. J. publ. Hlth* **28** no. 11 pp. 1305–1310. New York, N.Y., 1938.

This paper on the transmission of plague by fleas is based on experiments carried out over a period of two years in San Francisco [*cf. R.A.E.*, B **26** 87]. Approximately 1,200 fleas were kept separately in test tubes so that accurate information might be obtained on various points.

It was found that the plague bacilli in the blood of an infected animal are not numerous enough to infect fleas except during a short period before its death; the blood of guineapigs was not infective earlier than 36 hours before death, and it is improbable that the blood of other rodents is infective over a longer time. During this short interval, the degree of septicaemia varied greatly in different guineapigs and the percentage of fleas that became infected varied greatly in consequence. In most cases only a very small number of fleas became infected even though plague bacilli were numerous, and in no case did all fleas fed on one animal become infected. The development of *Bacillus (Pasteurella) pestis* in the stomach and proventriculus of fleas is described. Plague infection in living fleas can be determined by inoculation of their faeces into guineapigs. In San Francisco, more than 300 fleas have been infected and fed several thousand times, and individual infected fleas have fed from 50 to 100 times, without transmitting the disease. Less than 10 per cent. of fleas of wild rodents acted as vectors in the laboratory, which indicates that only a very small proportion of the fleas that have fed on infected wild rodents will infect other animals by their bites. The bites are only infective when the masses of plague bacilli prevent the passage of ingested blood into the stomach [*cf. loc. cit.*]; in experiments, fleas transmitted plague as early as 5 days and as late as 147 days after they had ingested the organisms. Very few infected fleas survived for more than 24–48 hours after there were indications of an obstruction to the flow of blood into the stomach, regardless of whether their bites were infective or not. Of the 45 fleas that transmitted plague in the laboratory, only about 20 per cent. infected more than one animal, even though some

of them attempted to feed. A flea that infected 10 animals and one of those that infected 5 animals were infective for 5 and 10 days, respectively. Although many males of different species were used, only 2 of the 45 fleas that transmitted plague were males [cf. 26 88], which suggests that females are more efficient vectors.

Of the 20 species of fleas in which plague infection was demonstrated, 11 transmitted the disease to guineapigs; 9 of these species were collected from wild rodents and the others were the rat fleas, *Xenopsylla cheopis*, Roths., and *Ceratophyllus (Nosopsyllus) fasciatus*, Bosc. The results indicated that any flea that feeds on septicaemic blood, regardless of its species, may become infected and, later, blocking of the oesophagus may make it a potential vector. Epidemiological data and laboratory studies show clearly that *X. cheopis* is a more dangerous and active vector than the other species tested. It is more readily infected when fed on septicaemic blood, it transmitted the disease to a larger number of guineapigs, it tends to become blocked earlier and to remain infectious longer, and, when blocked, it is very persistent in its efforts to obtain blood and in many instances it produced as many as 2 to 5 foci of infection on the abdomens of guineapigs at points where it had attempted to feed. Some individuals appear to be capable of infecting guineapigs every time they insert their proboscis. Multiple foci of infection were rarely produced by the bites of any other species. The average length of life of infected individuals was one month [cf. 26 88], with a maximum of 50 days, whereas many of the infected fleas from wild rodents and *C. fasciatus* remained alive for from 2 to over 4 months before they became blocked and died. It is possible that the disease is disseminated among rodents more frequently by means of infective faeces than is generally believed, since infected fleas may live for several months on rodents, continually depositing infective faeces on the fur and skin. Moreover, in recent experiments at San Francisco, *B. pestis* retained its virulence for as long as four weeks in dried flea faeces kept at room temperature.

Observations showed that all rodent fleas have to be starved to a greater extent before feeding on human blood than is necessary to induce them to feed on rodents that are not their natural hosts. It would appear that starved, blocked, plague-infected fleas of wild rodents may bite man when they come into contact with the skin, so that there is a danger of man contracting bubonic plague in all regions where wild rodents are infected.

JORDAN (C. F.). **Rocky Mountain Spotted Fever and Tick Survey in Iowa.**—*Amer. J. publ. Hlth* **28** no. 12 pp. 1411–1414, 9 refs. New York, N.Y., 1938.

An account is given of Rocky Mountain spotted fever in Iowa, where 38 cases occurred between 1933, when the first case was recorded, and 1938. Tick surveys were carried out during 1936 and 1937. All of 350 ticks sent for identification in 1936 proved to be *Dermacentor variabilis*, Say. Injection into guineapigs of material from 30 batches of this tick collected in 1936 gave no evidence of infection with the virus of Rocky Mountain spotted fever, but *Bacterium tularensis* was recovered from ticks taken in south-eastern Iowa; two out of the three infected batches were taken from dogs. In more extensive collections made in 1937, *D. variabilis* was taken from vegetation and on various small wild animals, horses, cows, sheep, goats, dogs and,

occasionally, cats. Ticks from two localities in which Rocky Mountain spotted fever had occurred in man harboured the virus. There was evidence in connection with 14 of the 38 cases that dogs were of importance in bringing the tick into contact with man; large numbers of dogs were found to be heavily infested, and the dog has been shown to be susceptible to the disease [cf. R.A.E., B 21 223].

FRICKINGER (H. W.). **Leitfaden der Schädlingsbekämpfung für Apotheker, Drogisten, Biologen und Chemiker.** [Elements of Pest Control for Pharmacists, Druggists, Biologists and Chemists.] —Med. 8vo, 331 pp., 230 figs., 1 pl. Stuttgart, Wiss. Verlagsges. m.b.H., 1939. Price M. 14·50.

This book is written with particular reference to the needs of chemists and others who require a brief survey of the chief pests that attack man, animals and cultivated plants in Germany, and of pests in dwellings, together with information on their control. In addition to sections on fungi, worms, molluscs, birds and mammals, there is a section on Arthropods (pp. 103–262) that is largely concerned with common insect pests. These are briefly described, with notes on their life-histories and habits, and recommendations for control. In many cases, proprietary products are recommended.

ROUBAUD (E.), COLAS-BELCOUR (J.) & STEFANOPOULO (G. J.). **Le comportement du virus de la fièvre jaune chez le moustique Aëdes geniculatus.** —*C. R. Acad. Sci.* **207** no. 24 pp. 1144–1146, 3 refs. Paris, 1938.

Further experiments were carried out in 1937 on the transmission of yellow fever by *Aëdes geniculatus*, Ol. [cf. R.A.E., B 25 201]. The method was the same, except that the five females that fed on an infected monkey (*Macacus rhesus*) were transferred after the infecting feed from 30 to 20–22°C. [86 to 68–71·6°F.], the normal laboratory temperature. Three of the females fed on the 18th day on a susceptible monkey, and two on the 22nd day. The mosquitos were shown by subsequent inoculation into mice to contain the virus, but the monkey remained healthy. It is concluded that the ability of this mosquito to transmit the virus becomes reduced at temperatures below 25°C. [77°F.].

GIRARD (R.). **Un cas d'évolution d'*Hypoderma bovis* De Geer sur le cheval.** —*C. R. Acad. Sci.* **208** no. 4 pp. 306–307, 1 fig., 2 refs. Paris, 1939.

Notes are given on the natural infestation of a horse in south-western France by *Hypoderma bovis*, DeG., larvae of which developed normally in this host [cf. R.A.E., B 27 22] and emerged from the warbles without difficulty.

BRUMPT (E.). **Une nouvelle fièvre récurrente humaine découverte dans la région de Babylone (Irak).** —*C. R. Acad. Sci.* **208** no. 25 pp. 2029–2031. Paris, 1939.

In the course of a journey in the Near East in 1937, the author observed a few cases of relapsing fever in man at Damascus, Beirut

and Palmyra. A search for ticks in the burrows of desert rodents near Palmyra gave negative results, but at Kish, near Babylon, three nymphs of *Ornithodoros asperus*, Warb., were taken from a deep burrow. The resulting adults were allowed to feed on guineapigs in the laboratory, and the two males were shown to be infected with a spirochaete. It did not differ morphologically from other spirochaetes of relapsing fever, but on the evidence of cross-immunity and transmission tests, the author considers it to be a new species, which he names *Spirochaeta babylonensis*. In its action on guineapigs, it resembled *S. hispanica*, which occurs in the Mediterranean basin and is transmitted by *O. erraticus*, Lucas, and *S. persica*, which occurs in Central Asia and Palestine and is transmitted by *O. tholozani*, Lab. & Mén., but in experiments it was not transmitted by the bite of either of these ticks. It was, however, easily transmitted to man and laboratory animals by *O. asperus*. Further experiments are to be carried out to determine whether *O. asperus* also transmits other spirochaetes.

In a brief discussion of work on the ability of various species of *Ornithodoros* to transmit spirochaetes with which they are not found infected in nature [cf. R.A.E., B 17 62; 21 244; 25 25, etc.], it is stated that *O. turicata*, Dugès, which is restricted to America, was found to be a good experimental vector of *S. babylonensis*, that *O. nicollei*, Mooser, which occurs in tropical Mexico, transmitted *S. duttoni* and *S. persica*, the latter in one case three years after the experimental infection, and that the Mexican *O. coriaceus*, Koch, occasionally transmitted *S. persica*.

Summaries of Reports of the All-Union Conference of Workers in Microbiology, Epidemiology and Infectious Diseases. Moscow, 25th-31st January 1939. [In Russian.]—Demy 8vo., 142 pp. Moscow, Medgiz, 1939.

One section of these reports (pp. 91–138) is devoted to diseases transmitted by Arthropods. Localities are not mentioned in those dealing with the vectors of the so-called taiga or spring-summer encephalitis, but there is some evidence in clinical papers of this series that it is confined to the Russian Far East [cf. also R.A.E., B 27 69]. The taiga is the type of primeval forest that occurs in Siberia. In The Rôle of the Parasitological Factor in the Epidemiology of the Spring and Summer Encephalitis (pp. 94–95), E. N. Pavlovskii states that recent investigations by various workers, including those mentioned below, have shown that three ticks, *Ixodes persulcatus*, Schulze, *Dermacentor silvarum*, Olen., and *Haemaphysalis concinna*, Koch, are vectors of this disease [cf. 27 70]. Naturally infected ticks were taken in localities in which cases of the disease occurred, and some of them were collected on rodents, domestic animals and a thrush. In experiments, nymphs and adults of *D. silvarum* that had fed in the larval stage on infected mice transmitted the disease by biting, and the virus was present in larvae of *D. silvarum* and *I. persulcatus* that were the offspring of naturally infected females. Experiments with suspensions of different organs of *H. concinna* showed that the virus circulates in the body of the tick and concentrates in the salivary glands, being probably transmitted to man through the saliva.

In The Tick *Ixodes persulcatus* as Transmitter of the Taiga Encephalitis (pp. 100–101), A. K. Shubladze & G. V. Serdyukova

state that in experiments in which 38 groups of naturally infected examples of this tick collected in endemic foci were fed on mice, encephalitis resulted in five cases after the ticks had fed for at least two days. The disease was also transmitted to mice by artificially infected ticks. Ticks that had fed for two or three days on mice infected with a large dose of the virus conserved it for over 60 days. Infection was also produced in mice by injection of a suspension of larvae that hatched from eggs laid by females collected in an endemic focus.

In The Identity of the Virus present in Pasture Ticks with the Virus of Taiga (Spring-Summer) epidemic Encephalitis (pp. 101–102), N. V. Ruizhov states that a virus isolated by him in 1937 from mice on which ticks taken in the field were allowed to feed proved to be identical with the virus of human taiga encephalitis. Seven strains isolated in 1938 by intracerebral inoculation of mice with a suspension of naturally infected ticks did not differ from the virus isolated in the preceding year.

In The Tick *Dermacentor silvarum* as Transmitter of the Taiga Encephalitis (pp. 109–110), N. V. Ruizhov & A. N. Skruinnik record experiments on transmission of the disease by artificially infected examples of this tick that were the offspring of females collected in the field or on cattle. The virus was detected in, and transmitted to mice by, both nymphs and adult females that had fed as larvae on infected mice, and was also detected in adult females that had been fed on healthy mice in the larval and infected mice in the nymphal stage. When infected by nymphs, the duration of the incubation period in mice was inversely proportionate to the number of ticks that fed on them.

In The Tick-borne Spotted Typhus (pp. 114–118), M. K. Yatzimirs-kaya-Krontovskaya gives a brief survey of the different types of typhus-group fevers and states that outbreaks of diseases, of which some had the clinical characters of the group of tropical typhus and others those of the group of spotted fevers [*cf.* 24 154], occurred in 1935–38 in the south and east of the Russian Union. The symptoms of a disease studied by the author, which was apparently a form of tropical typhus of the type of tsutsugamushi disease, are outlined; it was prevalent in spring and early summer, though isolated cases were observed in August–September. Investigations showed that the tick, *Dermacentor nuttalli*, Olen., the adults of which attack cattle, was a vector, and that the peak of the infection coincided with the maximum abundance of this tick in nature. It was the only species present in a focus of the disease, where it was found in a part of the steppe used for grazing cattle. Most of the persons infected had worked in the field or the steppe, and evidence of tick-bites was invariably present. In transmission experiments, infection was produced in healthy animals by the bites of infected larvae or adult ticks. Different strains of the virus were obtained from ticks taken in the field and on man, as well as on *Citellus* and rats. These strains have been maintained by passages through ticks for a period of over 7 months. Evidence has been obtained that the virus may be preserved in rats for over 60 days.

In Marseilles Spotted Fever in the Crimea (pp. 118–119), A. Ya. Aluimov states that the first cases of Marseilles fever in the Russian Union were observed by him in the Crimea in 1936, and that the disease has since occurred sporadically in a number of localities. The virus

has been isolated from patients and from examples of the tick, *Rhipicephalus sanguineus*, Latr., collected in different localities. This species, which usually attacks dogs, is widely distributed in the Crimea. In the course of a study of the blood of dogs, a positive Weil-Felix reaction was obtained. Since *R. sanguineus* is also present in various parts of the Caucasus and Central Asia, it is possible that Marseilles fever also occurs in these areas.

In The Excreta of Lice infected with Spotted Typhus as a Source of the Transmission of the Virus *per os* from diseased to healthy Lice (pp. 124-125), A. V. Pshenichnov states that, in laboratory experiments, the virus of typhus was present in the excreta of lice [*Pediculus humanus*, L.] 7 days after infection, and was particularly virulent 2-5 days later. In excreta of infected lice occurring on the underwear and skin of people immune from the disease, the virus preserved its virulence for at least 10 days. It appears that lice are as likely to become infected by feeding on skin soiled with virulent excreta as by feeding on persons suffering from the disease. In previous experiments by the author, healthy lice became infected after feeding on skin that had been contaminated with crushed infected lice. The author suggests that the excreta of lice may preserve the virus in nature between epidemics [cf. 27 60].

In The Rôle of the Parasitological Factor in the Epidemiology of Tularaemia (pp. 132-134), N. G. Olsuf'ev points out that recent investigations in the Russian Union have shown that the ticks of the genus *Ixodes* are among the chief vectors of tularaemia. If infected with *Bacterium tularensis* they harbour it throughout their life, they transmit it easily to rodents, sheep, camels and pigs, and they have been found infected in nature. Infected fleas (*Ctenophthalmus*) and Gamasid mites have been found in nests of rodents [cf. 23 85], and in preliminary experiments mites that had fed on diseased mice preserved the bacterium for 30 hours. Other experimental vectors are *Cimex lectularius*, L. [24 146], lice of the genus *Hoplopleura* [25 176] and Tabanids [26 11]. Tabanids were able to transmit the disease for 48-72 hours after feeding on a diseased animal or its carcass; they also transmitted it after they had had contact with water in which the decomposing carcass of a diseased rodent had been kept for a lengthy period. Spontaneously infected Tabanids occurred in the field. *Stomoxys calcitrans*, L., was able to transmit the disease for 24-48 hours after the infecting feed, and the bacterium was preserved in its internal organs for up to a week. In other experiments, mosquitos of the genera *Aëdes*, *Anopheles* and *Mansonia* were able to harbour the infection for periods of over a month [cf. 23 290; 25 275] and readily transmitted it by biting to sheep and rodents. The latter also contracted the disease when infected mosquitos were crushed on their unscarified skin.

[ALFEEV (N. I.).] Альфев (Н. И.). Comparative ecological Peculiarities of Ticks, *Dermacentor marginatus* Sulz. and *Ixodes ricinus* L.
[In Russian.]—*Zool. Zh.* 18 no. 1 pp. 99-109, 14 refs. Moscow, 1939. (With a Summary in English.)

Field observations carried out in 1934-37 in the Province of Orel (central Russia) showed that *Dermacentor marginatus*, Sulz., was most abundant in woods of deciduous trees where the soil was rather dry and contained little humus. Its development was protracted in

damp and shady places where humus was abundant. Adult unfed ticks were able to live for over two years. Insectivora and rodents were the chief hosts of the larvae and nymphs. The adults occurred on large domestic animals and dogs, but were not found on cats or, with the exception of one female taken on a wolf, on wild animals. They were very abundant on cattle and dogs in April, but their numbers decreased sharply with the advent of warm weather and the appearance of foliage in forests. No adults could be found on animals or elsewhere from the first half of June till about mid-August, but later they were again taken on cattle [cf. R.A.E., B 25 242]. Their apparent absence from the field was due to the fact that they entered a state of torpor; individuals placed on grass immediately made their way to sheltered places and became motionless. No oviposition occurred in August and later at temperatures that ranged from 6 to 30.8°C. [42.8–87.4°F.], but eggs were laid in the spring by overwintered engorged females, though the temperature was lower, ranging from 0.4 to 23.2°C. [32.72–73.76°F.].

No summer aestivation was observed in the case of *Ixodes ricinus*, L., adults of which were found on cattle, dogs, cats, hedgehogs [cf. 24 299], hares and a wolf. Only a few adults occurred on cattle and dogs at the beginning of the grazing period, but their numbers markedly increased in spring as the weather became warmer. They were present on the animals throughout the summer, though there was a gradual reduction in the intensity of infestation, owing to the fact that they also attacked wild animals.

Report of the North East of Scotland Sheep Tick Committee—1938.—
55 pp., 6 figs., 3 diagrs. [Aberdeen, 1939.]

This report comprises an introductory account of the formation in August 1937 of the Sheep Tick Committee of the North-East of Scotland and of the lines on which its work is being carried out, followed by appendices. The first of the appendices is a reprint of an article that appeared in the *Field* in March 1938, entitled The Sheep Tick Menace, in which brief descriptions are given of the morphology of the tick, *Ixodes ricinus*, L., its bionomics, seasonal prevalence and the injury it causes. In addition to the direct losses due to the irritation set up by tick bites and to loss of blood, this tick also acts as the vector of louping-ill and tick-borne fever of sheep and red-water [*Piroplasma bovis*] of cattle. Notes are also given on *Melophagus ovinus*, L., with which the tick may possibly be confused, and the formation of the Sheep Tick Committee and its activities. The second appendix contains information additional to this article for submission to the Ministry of Agriculture and Fisheries and the Scottish Office, prior to their receiving a deputation from the Committee; this gives details of the spread of the tick, of the losses it causes and of the measures suggested for its control. The third consists of the correspondence that passed between these government authorities and the Committee, in which the former, although approving the work of the Committee, refused its request to introduce legislation for tick control on the grounds that further research is needed before it can be shown that administrative control would produce the desired results.

The fourth appendix is a report by Walter Moore on the general investigations on tick control that are being carried out by the North of Scotland College of Agriculture. *I. ricinus* infests red and roe

deer, sheep, cattle, horses, pigs, dogs, cats, hares, stoats, weasels and man. Infestation of animals is usually by larvae, nymphs or adult females, but instances have been noted in which male ticks were attached to and apparently feeding on deer, sheep and man. Rabbits are infested in some localities but apparently not in others. The larvae and nymphs have been found on various wild and game birds and on poultry. The occurrence of adult females on birds appears to be accidental, though single females have been found in five instances on grouse. The distribution and seasonal prevalence of the tick is discussed, together with the results of experiments on methods of control. In experiments on serial dipping, the dip that has given 100 per cent. kill of all stages of the tick consists of 1 part *Derris elliptica* root (containing 5 per cent. rotenone) and 500 parts water. It was found that when sheep were immersed for at least 30 seconds they were protected from reinfection for 9–10 days; immersion for one minute is therefore recommended. Water solutions or emulsions mix readily with water and are therefore easily brushed off the bare skin beneath the legs where the tick is chiefly found. Moreover, in lambs metabolic processes are so rapid that any reactive substance placed on the skin is rapidly absorbed. Experiments are therefore being carried out to evolve a waterproof oily smear that can be applied by hand to the skin; a mixture consisting of a mineral oil, wool grease and pyrethrum extract protected lambs for 30 days, but the smearing proved a laborious process and attempts are now being made to devise a mechanical means of application. Experiments have also been carried out with a power spraying unit that can be transported to the hills and permits the treatment of small batches of sheep on the spot, either in a spray chamber or by hand with power sprayers. The importance of reducing such alternative hosts as deer, hares and rabbits on sheep grazing land is emphasised [cf. R.A.E., B 27 93]. Dipping should begin as soon as possible in May and be continued at intervals of not more than three weeks until mid-September.

The fifth appendix is an article by J. Glass on heather burning and hill drainage, in which he discusses the value of good moor management in increasing the carrying capacity of grazings for both sheep and grouse. He found that in summer fully engorged female ticks died in three days unless they fell into, or within a few feet of, suitable shelter, such as old heather or other rough vegetation where they could get cover and moisture. They cannot exist for any length of time when exposed to ordinary climatic conditions. Thus, burning of old heather is of value in a campaign against ticks, since it destroys much of the suitable harbourage.

EDWARDS (F. W.), OLDROYD (H.) & SMART (J.). **British Blood-sucking Flies.**—Super roy. 8vo, viii+156 pp., 45 pls. (44 col.), 64 figs., many refs. London, Brit. Mus. (Nat. Hist.), 1939. Price 15s.

Of about 5,200 known species of British Diptera, 119 suck blood; these belong to the three sub-orders Nematocera, Brachycera and Cyclorrhapha. The text dealing with these sub-orders has been compiled by Edwards, Oldroyd and Smart, respectively, and includes keys to the species of British blood-sucking Culicids, Ceratopogonids (*Culicoides*), Simuliids, Tabanids, Muscids, Hippoboscids and Nycteriobiids (which comprise 29, 27, 19, 28, 3, 9, and 2 species, respectively) and brief summaries of the known facts regarding their bionomics and

distribution. Male mosquitos, which do not suck blood, are not dealt with. Short bibliographies are given at the ends of the sections or chapters. There are two appendices, *The Genitalia of the British Culicoides with Notes on Synonymy*, by Edwards, and "Gad-flies," by E. E. Austen. Seven new species of *Culicoides* are described, two of them in the first appendix.

PHILIP (C. B.). Some Useful Paraphernalia in Parasitological Entomology.—*Turtox News*, July 1938, repr. 3 pp., 3 figs.

Notes are given on various simple pieces of apparatus, based on ideas that are largely refinements of or deviations from well-known procedures, that have been found useful in connection with studies on diseases transmitted by Arthropods. They include a cage for feeding mosquitos on small animals, in which the visibility is improved by certain modifications, the various articles needed to furnish a battery jar in which guineapigs or mice are kept during the feeding of haemophagous bugs, and "collecting cones" that have been found useful for collecting sluggish engorging Simuliids from the ears of horses, etc.

CHADHA (S. R.) & SONI (B. N.). Regional and Seasonal Distribution of Warble Fly (*Hypoderma lineatum*) and its economic Importance in the North-West Frontier Province.—*Indian J. vet. Sci. Anim. Husb.* 9 pt. 1 pp. 101–103, 1 figd. map. Delhi, 1939.

Data on the regional and seasonal distribution of *Hypoderma lineatum*, Vill., on cattle in the North-West Frontier Province were collected during the year 1937–38. Information regarding hides sold in the market indicated that the earliest damage to the skin occurred in August. Observations during the winter season showed that the percentage of infested animals in certain villages was as high as 80 and in no case lower than 50; the percentage of damaged hides was 20–60, the lower figures being obtained in May and September, that is, towards the end and the beginning of the season when hides were brought to the market. The percentage of goat skins damaged by *H. crossi*, Patt., ranged from 15 to 65; in certain localities it was hardly possible to find a single goat free from warbles.

Infestation by warble-flies was heavy in hilly districts. They are rare in marshy land but abundant in dry sandy areas. The losses due to them are discussed. It is suggested that the variation in the times of appearance of the tumours in the backs of the animals in different localities may be due to differences in topography and climate. In a hilly tract they were first observed on 1st September. In certain plains they were noticed about the beginning of October and were largest about the middle of December 1937 and the beginning of January 1938. Larvae were seen emerging about the middle of February in the plains and about a fortnight later in the hills.

GOMES DE MORAES (R.). Breve nota sobre [on] *Ornithocoris toledo* Pinto 1927 (Insecta-Hemiptera).—*Rev. med.-cirurg. Brasil* (2) 47 no. 4–5 pp. 250–255, 4 figs. Rio de Janeiro, 1939. (With a Summary in English.)

The Cimicid, *Ornithocoris toledo*, Pinto [R.A.E., B 18 20], is redescribed from individuals taken in a fowl house in Brazil. Even starving individuals did not bite man.

DA CUNHA (A. M.). **A agglutinação e o diagnóstico diferencial das leishmanias.** The Agglutination and the differential Diagnosis of the Species of *Leishmania*. —*Brasil-Médico* **52** no. 38 pp. 849–855. Rio de Janeiro, 1938.

An account is given of a number of serological tests with strains of *Leishmania donovani*, *L. infantum*, *L. tropica* and *L. brasiliensis* and of the causal organism of American visceral leishmaniasis from Brazil, for which the name *L. chagasi* has been suggested [R.A.E., B **26** 89]. It is concluded that the parasite causing the disease in America is identical with *L. infantum* [cf. **27** 158].

CASTRO FERREIRA (L.), MANGABEIRA FILHO (D.), DEANE (L.) & CHAGAS (A. W.). **Notas sobre a transmissão da leishmaniose visceral americana.** [Notes on the Transmission of American Visceral Leishmaniasis.]—*Hospital* **14** no. 5 pp. 1077–1087, 16 figs. Rio de Janeiro, 1938.

In the first note, the first three authors describe observations made in June 1938 in an area in Pará, Brazil, where visceral leishmaniasis occurs, on sandflies (*Phlebotomus*) that had fed on a naturally infected dog showing numerous leishmaniae in the skin. Leptomonad forms identical with those found in cultures of *Leishmania chagasi* were found in two females out of six that had fed 3–4 days previously on the dog. One of the two infected females was identified and proved to be *Phlebotomus longipalpis*, Lutz & Neiva.

In the second note, the same authors describe the breeding places of sandflies discovered in the course of a systemic search in the vicinity of houses in the above-mentioned area. Larvae were found in mud and earth at the base of the supporting posts of dwellings, in the props themselves, in straw in fowl houses and dwellings, in rotten sticks near houses, in the damp and half-rotten parts of the floor of houses, in earth mixed with human excreta, at the bases of certain trees near houses, in undergrowth, in dry and rotting leaves, and in the surface soil taken from fowl houses. Sandflies were successfully reared from egg to adult, the life-cycle occupying 44 days, and further batches of eggs were obtained.

In the third note, Chagas gives an account of the way in which adults of *Phlebotomus intermedius*, Lutz & Neiva, were trapped and rearing carried out in the laboratory. Larvae were fed on a mixture of guineapig faeces and rabbit blood (10 : 1). Females reared in the laboratory were usually fed on dogs infected with American visceral leishmaniasis, but 145 of them, which were dissected 3–8 days after feeding, showed no infection. With a view to carrying out transmission experiments with *P. longipalpis*, an attempt was made to rear this species in Rio de Janeiro from eggs and larvae sent by aeroplane from Pará. Possibly owing to the altitude of flight, the material arrived in poor condition and only 4 males and 1 female were obtained from the eggs.

CHAGAS (A. W.). **Infecção de "Phlebotomus intermedius" pela "Leishmania chagasi."** Infection of *Phlebotomus intermedius* with *Leishmania chagasi*.—*Brasil-Médico* **53** no. 1 pp. 1–2, 2 figs. Rio de Janeiro, 1939.

The author gives the results of experiments in which both trapped and reared females of *Phlebotomus intermedius*, Lutz & Neiva see

preceding paper] were fed on a dog naturally infected with American visceral leishmaniasis, which showed numerous leishmaniae in the skin. Four out of ten, including two reared ones, were found to be infected 3-6 days after feeding, and a single reared female of *P. longipalpis*, Lutz & Neiva, fed on the same dog, was positive after 4 days. The case with which the two species became infected when fed on a naturally infected dog suggests that the condition of the animal reservoir is the most important factor in the transmission of the disease. The negative results previously obtained with *P. intermedius* [*loc. cit.*] were probably due to the fact that the sandflies were fed on an experimentally infected dog that showed far fewer parasites in its skin. Of the two species, *P. longipalpis* is probably the more important vector, since it predominates in the foci of the disease in Brazil.

JERACE (F.). *I flebotomi degli Abruzzi. IIIa nota. (Distribuzione e biologia dei flebotomi in prov. di Teramo.)*. [Sandflies of Abruzzi. 3rd Note. (The Distribution and Biology of the Sandflies in the Province of Teramo.)]—*Ann. Igiene* **49** no. 5 pp. 309-315, 1 map, 9 refs. Rome, 1939.

In the course of investigations on the relation of sandflies (*Phlebotomus*) to cutaneous leishmaniasis in Abruzzi [cf. *R.A.E.*, B **27** 62, 142, 165], the author collected 218 males and 1,445 females in the province of Teramo between June and September 1938. Of the three species represented among them, *P. perfiliewi*, Parr., was always abundant in areas where the disease was common, while *P. papatasii*, Scop., and *P. perniciosus*, Newst., were found in single localities, in which *P. perfiliewi* and cases of the disease also occurred. *P. papatasii* was scarce.

Some biological observations were made on sandflies of the group of *P. major*, Annan. They were very numerous in the shore zones near the sea and in the hilly areas up to an altitude of about 2,600 ft. They attacked man readily, being attracted by light-coloured surfaces, especially white clothes, and settled preferably on the face, neck and arms. They were difficult to find in houses by day. The larvae occurred at and near the base of old walls, especially in débris and cracks in beaten earth. The sandflies were successfully reared from egg to adult by a method practically identical with one already noticed [15 132]. Descriptions are given of this method, and also of the technique of preparing specimens for morphological studies.

RODHAIN (J.) & MUYLE (G.). *Sur la spécificité des Plasmodium des anthropoïdes de l'Afrique centrale*.—*C. R. Soc. Biol.* **127** pp. 1467-1468, 5 refs.; *op. cit.* **131** pp. 114-117, 2 refs. Paris, 1938-39.

An account is given of experiments in which strains of malaria parasites from man and chimpanzees were injected into chimpanzees and man, respectively, in order to determine their specificity. The results indicate that *Plasmodium reichenowi* and *P. schweitzeri* [cf. *R.A.E.*, B **27** 193] are distinct from *P. falciparum* and *P. vivax*, respectively. It is stated that attempts to bring about the development of *P. reichenowi* in *Anopheles maculipennis*, Mg., were unsuccessful.

ALVARADO (C. A.). **Métodos de lucha antipalúdica en la República Argentina.** [Methods of antimalaria Work in Argentina.]—*Bol. sanit. Dep. nac. Hig. Argent.* **3** no. 1 pp. 891-915, 15 figs., 2 pls. Buenos Aires, 1939.

Some of the data already noticed [*R.A.E.*, B **27** 12] on the importance of *Anopheles pseudopunctipennis*, Theo., in relation to malaria in Argentina, and on its breeding habits and control are briefly reviewed, and an account is given of a method that the author has found effective during the past few years for preventing it from breeding in backwaters, irrigation channels, and narrow pools formed by the widening of small streams at certain points of their courses. It consists in clearing the channel so that the water flows easily and its width is reduced, and then constructing a framework of stems across it on which are laid branches and leaves to form a cover. This cover prevents the adult mosquitos from gaining access to the water and renders it unsuitable for the larvae because the alga (*Spirogyra*) on which they depend cannot grow in shade. If the water is liable to rise above the cover and so render it ineffective, 40-gallon iron drums are placed beneath the framework to serve as floats. The framework, which is loosely put together, can then adjust itself to a rise or fall.

RUSSELL (P. F.) & MOHAN (B. N.). **Staining Malaria Oocysts in Living Mosquitoes.**—*J. Parasit.* **25** no. 3 pp. 278-279. Lancaster, Pa, 1939.

It has been found possible to stain oocysts of *Plasmodium falciparum* in *Anopheles stephensi*, List., by feeding the mosquitos on a 10 per cent. glucose solution to which has been added a small quantity of eosine (water-soluble). In mosquitos that fed on this solution for two days, the oocysts were clearly stained and so more readily seen on dissection of the mid-gut. Sporozoites were not stained with eosine.

MACY (R. W.). **Gomphus spicatus Hagen (Odonata) a new intermediate Host for Prosthogonimus macrorchis (Trematoda).**—*J. Parasit.* **25** no. 3 p. 281. Lancaster, Pa, 1939.

Of six naiads of *Gomphus spicatus*, Hagen, obtained from a lake in Minnesota on 4th June 1936, two were dissected and found to contain 15 and 25 cysts, respectively, of *Prosthogonimus macrorchis*. These cysts, together with the remaining naiads were fed to a laying hen on the following day. The hen was killed 22 days later, and 20 large specimens of the fluke were found in the oviduct. *G. spicatus* is very common in the north-eastern United States and Canada and is reported to be abundant in Toronto. It is a mud dweller, and in this respect differs from other dragonflies concerned in the transmission of *P. macrorchis*. Since adults emerge during the last part of May and the first part of June, poultry should be fenced off from the shores of lakes at this time cf. *R.A.E.*, B **23** 40. Ducks, which frequently feed in the mud, would be especially liable to become infested with *Prosthogonimus* through feeding on *Gomphus*.

PAPERS NOTICED BY TITLE ONLY.

- JELLISON (W. J.). Notes on the Fleas of Prairie Dogs [*Cynomys* in U.S.A.], with the Description of a new Subspecies.—*Publ. Hlth Rep.* **54** no. 20 pp. 840–844, 8 figs., 1 ref. Washington, D.C., 1939.
- SCHULZE (P.). Zur Zeckenfauna Burmas. [The Tick Fauna of Burma.]—*Z. Parasitenk.* **10** no. 6 pp. 722–728, 4 figs., 10 refs. Berlin, 1939.
- SCHMIDT (W. J.). Ueber physikalische und chemische Eigenschaften des Sekretes, mit dem *Pediculus capitis* seine Eier ankittet. [The physical and chemical Qualities of the Secretion with which *P. humanus capitis*, DeG., attaches its Eggs.]—*Z. Parasitenk.* **10** no. 6 pp. 729–736, 6 figs., 6 refs. Berlin, 1939.
- TRAGER (W.). Intracellular microorganism-like Bodies in the Tick *Dermacentor variabilis* Say.—*J. Parasit.* **25** no. 3 pp. 233–238, 1 pl., 1 fig., 9 refs. Lancaster, Pa., 1939.
- GABALDON (A.). A Method for Mounting Anopheline Eggs.—*J. Parasit.* **25** no. 3 p. 281. Lancaster, Pa., 1939.
- [BEKKER (É.)]. Беккер (Э.). On the Mechanism of Feeding in Larvae of *Anopheles*. The Mouth Apparatus of the Larva of the Malaria Mosquito and its Movements in Feeding upon Organisms on the Surface Film of Water. Part II. The Mandible Apparatus of the Larva of *Anopheles* [*maculipennis*, Mg.] and its Functions. [In Russian.]—*Zool. Zh.* **17** no. 5 pp. 741–762, 19 figs., 2 refs. Moscow, 1938. (With a Summary in English.) [Cf. R.A.E., B **27** 224.]
- SERGENT (Et.). Sur l'oeuf d'*Anopheles maculipennis melanoon* Hackett du littoral algérois.—*Arch. Inst. Pasteur Algérie* **17** no. 1 pp. 59–61, 1 pl., 2 refs. Algiers, 1939.
- SENEVET (G.) & ABONNENC (E.). Les moustiques de la Guyane française—II. Le genre *Culex* [including 8 new species and keys based on the larvae and male hypopygia.]—*Arch. Inst. Pasteur Algérie* **17** no. 1 pp. 62–134, 34 figs., 14 refs. Algiers, 1939. [Cf. R.A.E., B **27** 210.]
- STRICKLAND (C.). A Study in Physiography in Relation to Malaria [and *Anopheles sundanicus*, Rdnw.] in the Orissa Coastal Tracts.—*Riv. Malariaol.* **18** (1) fasc. 1 pp. 38–44, 4 pls., 2 refs. Rome, 1939. (With Summaries in English and Italian.) [Cf. R.A.E., B **27** 9.]
- WATSON (Sir M.). Malaria and Mosquitoes : Forty Years On [a general review of control work].—*J. R. Soc. Arts* **87** no. 4505 pp. 482–502. London, 1939.
- DINGER (J. E.). Yellow Fever [a review of present knowledge].—*Bull. colon. Inst. Amst.* **2** no. 3 pp. 218–230. Amsterdam, 1939.
- KERN (R. A.). Asthma due to Sensitization to a Mushroom Fly, *Aphiochaeta* [*Megaselia*] *agarici*.—*J. Allergy* **9** no. 6 pp. 604–606. St. Louis, Mo., 1938.

CUTHBERTSON (A.). **The Breeding Habits and Economic Significance of some common Muscoidean Flies (Diptera) in Southern Rhodesia.**—*Proc. Rhod. Sci. Ass.* **36** pp. 53-57. Salisbury, S. Rhod., 1938.

Notes are given on the feeding and breeding habits of various species of *Musca* and *Fannia* that are common in Southern Rhodesia, of species of *Stomoxys* associated with cattle and horses, and of blowflies that cause myiasis in cattle and sheep.

ROBERTS (F. H. S.). **[Report of the Entomologist and Parasitologist, Animal Health Station, Yeerongpilly.]**—*Rep. Dep. Agric Stk Qd 1937-38* pp. 110-111. Brisbane, 1938.

The results of a survey of cattle lice in Queensland and of experiments on their control are briefly noted [cf. *R.A.E.*, B **26** 148, 214]. An examination of 82 dogs in the Brisbane area towards the end of 1937 showed that the commonest species of fleas present were *Ctenocephalides felis*, Bch., and *C. canis*, Curt., which constituted, respectively, 65.17 and 33.42 per cent. of the 2,998 fleas collected. As a result of the recent record of the presence of the stickfast flea *Echidnophaga gallinacea*, Westw.] on dogs in south-eastern Queensland [**26** 109], a survey, which is not yet complete, is being carried out in the southern and western parts of the State; no trace of *E. gallinacea* has so far been found, specimens of stickfast fleas from dogs in two localities proving to be *E. myrmecobii*, Roths. [cf. **27** 205]. *Haemaphysalis bispinosa*, Neum., is becoming a serious pest of cattle in several areas on the north coast and on one occasion was present in large numbers on sheep. It does not appear to be a vector of piroplasmosis of cattle, but when sufficiently abundant may cause severe "tick worry." As it is a three-host tick and all stages are of long duration, it is difficult to control. A case is recorded in which the bite of *Ornithodoros gurneyi*, Warb., caused serious symptoms in a man, who suffered from vomiting, blindness and unconsciousness lasting about an hour. In the central and south-western areas, Simuliids appear in swarms after the flooding of the rivers by the summer rains and viciously attack sheep, congregating about the eyes and in the nostrils and ears; serious losses among lambs have been reported.

HENRY (M.). **The Kangaroo Tick.**—*Aust. vet. J.* **14** no. 2 pp. 69-71. Sydney, 1939.

The author has collected information from various sources on the kangaroo tick, *Ornithodoros (Argas) gurneyi*, Warb., which is widely distributed in Australia, and is found on kangaroos and other native animals, dogs and, occasionally, man. The adult ticks are said to occur in the soil under trees, bushes, etc., in kangaroo camps, in wallaby caves and elsewhere. On man they become fully engorged in 5-10 minutes. The bite may give rise to alarming symptoms cf. preceding paper].

TWINN (C. R.). **Notes on some Parasites and Predators of Blackflies (Simuliidae, Diptera).**—*Canad. Ent.* **71** no. 5 pp. 101-105, 13 refs. Guelph, 1939.

These notes on certain parasites and predators of Simuliids are based on the literature and on observations made by the author over a

period of several years in Canada, chiefly in the Ottawa district. The parasites found in this district include a microsporidian that has been identified as *Thelohania (Glugea) varians (Nosema simulii)*; it occurred commonly in the larvae of a number of species of *Simulium* between April and September, but the highest percentage of parasitism observed was 24·5. Nematodes of the genus *Mermis*, which are probably common parasites of the larvae of *Simulium* in eastern Canada, were observed in *S. multidentatum*, Twinn, and *S. venustum*, Say. Of 276 larvae taken from one stream, 22·8 per cent. were parasitised. The Nematodes leave their hosts through the anus or the integument between the abdominal segments and kill them in so doing. Various aquatic forms of insects, some of which are predatory, occur in rivers and streams in which Simuliids develop. Where larvae of Trichoptera were common, Simuliid larvae were often scarce or absent, and one was seen to seize a larva of *Simulium* in its mandibles. Larvae of Hydrachnid mites were found in one instance on the pupae and adults of *S. pictipes*, Hagen. Larvae of *S. vittatum*, Zett., were found in the stomach of the horned dace or creek chub (*Sematilus atromaculatus*), which is common and widely distributed in the streams of eastern Canada. A fungus, resembling a species of *Saprolegnia* parasitic on fish, was found on dead pupae of Simuliids, but it may have been merely a saprophyte.

KILGORE (L. B.). Insect Repellents. A Study of the Comparative Repellency by the Sandwich-Bait Method using confined House Flies.—*Soap* 15 no. 6 pp. 103, 105, 107, 109, 111, 123, 3 figs., 7 refs. New York, N.Y., 1939.

The author describes a method for evaluating materials soluble in alcohol as insect repellents, using the house-fly (*Musca domestica*, L.) as the test insect. It has been used for four years and the results have been substantiated by other workers using other insects. Strips of white blotting paper (1×4 inches) on which a bait consisting of black molasses has been spread in a narrow band down the centre and allowed to dry are covered with strips of thin, porous, highly absorbent paper of the same size that have previously been immersed in an alcoholic solution of the material to be tested and allowed to dry. A commercial grade of citronellol, a component of citronella oil that can be prepared synthetically, was used as the standard repellent. In tests, six bait strips are used; four of the corresponding cover slips are impregnated with 10, 20, 40 and 60 per cent. citronellol and the other two with 20 per cent. of the unknown substance. The order in which the six strips are fastened to the cardboard backing on which they are offered to the flies, and the reasons for this order, are explained. The baits are exposed in a special stock cage that will confine 2,000 flies in an insectary maintained at 80°F. and 60 per cent. relative humidity. Humidity seems to have an important bearing on the feeding activity of the flies. More consistent results were obtained when the flies were more than five days old, and the optimum response was induced in flies that had been starved for 12 hours. Observations should be made at intervals of about 15 minutes. An actual count is made of the flies feeding on each bait at the time, but in cases where the number exceeds 50, it is noted as 50 plus, and a value of 100 is arbitrarily assigned when the bait is completely covered with feeding flies. It has also been found to be of considerable value to take

photographs at these intervals. Details are given of a test on oil of pennyroyal made in this way. Since the flies began to feed on the two baits protected by 20 per cent. pennyroyal after they had practically exhausted the bait covered with 10 per cent. citronellol but shortly before they began to feed on that covered with 20 per cent. citronellol, oil of pennyroyal is regarded as having a repellent value of $\frac{1}{2}$ to 1 as compared with the standard. The results obtained from several chemicals tested in this manner are shown in a table. Butyl mesityl-oxide-oxalate at a concentration reduced to 5 per cent. still gave better results than 60 per cent. citronellol.

CAMERON (G. R.), DONIGER (C. R.) & HUGHES (A. W. McK.). **The Toxicity of Lauryl Thiocyanate and *n*-Butyl-carbitol-thiocyanate (Lethane 384).**—*J. Path. Bact.* **49** no. 2 pp. 363-379, 3 pls., 1 ref. London, 1939.

An account is given of experiments on the toxicity to laboratory animals of lauryl (dodecyl) thiocyanate and *n*-butyl-carbitol-thiocyanate, which are now being used in England as contact insecticides against the bed-bug [*Cimex lectularius*, L.]. For this work they are diluted, usually with kerosene, to about 1 : 64 and 1 : 40, respectively. The *n*-butyl-carbitol-thiocyanate was tested in the form of lethane 384, a commercial preparation that consists of equal parts by volume of the thiocyanate and a highly refined petroleum distillate. The methods of exposure included contact in miniature houses sprayed with the undiluted and diluted liquids, skin applications, oral administration and injections. Undiluted lauryl thiocyanate was fatal to experimental animals only when introduced into the body in fairly large amounts, while lethane 384 was fatal in much smaller quantities. In dilutions similar to those used against bed-bugs, they produced no ill effects, and in such dilutions are unlikely to be dangerous to man. Undiluted lauryl thiocyanate causes severe local reaction when applied to the skin, and lethane a slight reaction. The skin should, therefore, be protected when handling the undiluted liquids.

PAGE (A. B. P.), LUBATTI (O. F.) & GLOYNS (F. P.). **The Ventilation of Houses after Fumigation with Hydrogen Cyanide.**—*J. Hyg.* **39** no. 1 pp. 12-34, 1 col. pl., 5 figs., 4 refs. London, 1939.

Since workmen complained of sickness when reconditioning houses that had been aerated for 24 hours after being fumigated with hydrocyanic acid gas for the control of bed-bugs [*Cimex lectularius*, L.], it was decided that systematic tests should be made, during both fumigation and ventilation, to ascertain the change in concentration of the fumigant in the air in various positions in houses, and the proportion of hydrogen cyanide that could be recovered from plaster removed from partitions after 24 hours' airing. The data obtained might be expected to indicate the efficiency against bed-bugs of HCN fumigation as commonly carried out in England, and the amount of ventilation necessary before reoccupation of premises is permitted. Immediately after HCN is released in the free spaces of the house, the concentration begins to be diminished by leakage through cracks into the open air and penetration into hidden spaces, such as the interior of walls and floors, or by absorption by building and furnishing materials. When the doors and windows are opened, the gas in the free spaces is dispersed quickly, that absorbed by the materials is

given off gradually, and most of that in the hidden spaces diffuses out again. The rate of removal of gas from fumigated materials depends largely on the ease with which the gas being given off is removed by airing. If, when a house is re-occupied, the doors and windows are closed before all the absorbed gas has been removed by airing, there is a possibility that enough will be given off from floors, walls, furniture, etc., to build up a dangerous concentration. A survey of the literature showed that the concentration of HCN that can be tolerated by man for long periods has not been accurately determined, but it was decided from available data that 0·03 oz. per 1,000 cu. ft. (0·0026 per cent. by volume) could be endured for many hours.

The experiments were carried out in furnished and unfurnished houses and in houses in which fires were lit after airing in both summer and winter. The houses are described and floor plans are given. The methods used for determining the concentration of the gas are described, and the results are shown in tables and discussed. The experiments confirm, in general, the efficacy of hydrogen cyanide as a fumigant against bed-bugs. It would appear from the work of H. H. S. Bovingdon that the concentration lethal to bugs exposed for 6 hours at 15–20°C. [59–68°F.] is about 0·086 per cent. by volume (1 oz. per 1,000 cu. ft.). A list is given of the spaces in which the maximum concentration was below this figure, but it is pointed out that some of them are unlikely to be infested and that in others, such as piles of clothes, airing is so slow that the effective period of fumigation may be more than 6 hours. In many hidden spaces, the concentration at the end of 6 hours is rising, or at least remaining steady at a useful value, and the fumigation would therefore be rendered even more effective if the period of exposure were prolonged. In these experiments the roof space was sealed off and very little gas leaked into it. It is, however, doubtful if this space could have been fumigated unless the tiles had been laid on close boarding or set in cement. Bugs are often found in the roof space, and these may re-infest the living quarters.

Recommendations for fumigation and ventilation are made, and a number of precautions are suggested. A method of performing the benzidine acetate-copper acetate test for measuring the concentration of HCN, including the preparation of the test solution, is described.

BUXTON (P. A.). The Louse. An Account of the Lice which infest Man, their Medical Importance and Control.—Demy 8vo, ix+115 pp., 28 figs., 7 pp. refs. London, E. Arnold & Co., 1939. Price 7s. 6d.

In the first chapter the author deals with the zoological position and general biology of the Anoplura, in the four succeeding chapters with the anatomy, biology, medical importance and control of *Pediculus humanus*, L. (including race *capitis*, DeG.), in the sixth chapter with the anatomy, biology and control of *Phthirus pubis*, L., which is not known to be of importance in the transmission of disease, and in an appendix with the methods of rearing and feeding lice and of infecting them with *Rickettsia* by rectal injection. The section on the medical importance of *P. humanus* includes a discussion of trench fever, epidemic typhus and epidemic relapsing fever, which are transmitted by this louse, the various species of *Rickettsia* and the diseases they cause, and the tick-borne relapsing fevers.

DE JESUS (P. I.), JAO (S. G.) & GARCIA (E. Y.). **Malaria Survey of Calauan, Laguna.**—*J. P. I. med. Ass.* **18** no. 5 pp. 291-310, 9 refs. Manila, P. I., 1938.

In the course of this report on malaria in the municipality of Calauan, Luzon, an account is given of surveys of adult and larval Anophelines, details of which are shown in tables. It was found that malaria was endemic. Adults of *Anopheles minimus* var. *flavirostris*, Ludl., were collected in fairly large numbers and with regularity in their hiding places along streams, and in large numbers during a week in August in a trap in which a buffalo was used as a bait. Larvae and pupae were constantly found in large numbers in most of the streams and were also found frequently in shallow wells [cf. *R.A.E.*, B **21** 9]. Although *A. minimus* var. *flavirostris* is known to be the most efficient vector of malaria in the Philippines, it is pointed out that it may not be the only one in Calauan, where *A. mangyanus*, Banks, and *A. filipinae*, Mnlg., are also abundant. It was concluded that the high spleen and parasite indices prevalent among the permanent residents were mainly due to defects in the organisation of control measures, which consisted in clearing and dusting with Paris green.

EJERCITO (A.). **Biological Control of *Anopheles funestus minimus* Subgroup Breeding in the Philippines. I. A critical Study on Biological Control of *A. minimus* var. *flavirostris* as an anti-malaria Measure at the Hacienda Tala, San Jose del Monte, Bulacan.**—*J. P. I. med. Ass.* **18** no. 7 pp. 415-435, 1 map, 1 fldg. table, 1 fldg. graph, 3 pls., 6 refs. Manila, P. I., 1938.

A detailed account is given of measures carried out in 1935 and 1936 for the control of Anopheline breeding on a tobacco plantation where *Anopheles minimus* var. *flavirostris*, Ludl., was the predominant Anopheline and the only one found to be infected with malaria parasites. The measures, which were designed to alter or destroy the breeding places or adult resting places of the vector, consisted in clearing the banks of streams and so exposing them to the sun, sloping the banks and straightening their edges at water level, causing stagnation of the water by erecting series of dams, and channelling. The reductions in the densities of larvae and adults and in the number of cases of malaria are discussed, and it is concluded that the decrease in the incidence of malaria is attributable to the control measures and not to natural causes.

ZOTTA (G.). **Contribution à l'étude de la distribution des races d'*Anopheles maculipennis* en rapport avec les grandes lignes de répartition du paludisme en Roumanie.**—*Arch. roum. Path. exp. Microbiol.* **11** no. 2 pp. 209-246, 5 graphs, 2 maps, 4 refs. Paris, 1938.

Four species of *Anopheles* have been found in Rumania. *A. plumbeus*, Steph., breeds in tree-holes in forests, particularly those of the sub-Carpathian hills. *A. claviger*, Mg. (*bifurcatus*, auct.) has a wider distribution and is found from the sub-Carpathian region to the lower parts of the Moldavian-Bessarabian plain and in Munteni up to the flood zone of the Danube, which extends for about 600 miles from Brăila to Bazias with a width of about 2-12 miles. *A. hyrcanus* var. *pseudopictus*, Grassi, is very numerous in the Danube delta, but is also

found in the interior of the country in brackish water. *A. maculipennis* Mg., occurs practically throughout the country and is the only malaria vector of importance.

The incidence of malaria is discussed. It occurs almost everywhere except in the mountains and is endemic in certain regions. The whole of Bessarabia, more than two-thirds of Moldavia and all of the Dobrogea are the most severely affected, followed by Wallachia and the marches of the west and north-west (Banat, Bihor and Maramures).

The distribution of the races of *A. maculipennis* [cf. R.A.E., B 23 94], which is shown in tables under departments and localities, was deduced from a study of about 66,000 batches of eggs carried out between 1933 and 1938. Race *messeae*, Flni., predominates in the flooded zones where there are immense stretches of permanently stagnant water, such as are found in the Danube delta, in the flood zones of the Danube and the Dniester (where race *maculipennis* also occurs) and in the lower parts of the valleys of the Sereth and the Pruth. These large rivers carry a huge volume of water, and their floods extend over rich alluvial soil. The rivers in all the other valleys traversing Moldavia, Bessarabia and Wallachia are torrential in the first part of their course, but subsequently meander slowly from one side of the valley to the other, forming marshy zones hundred of kilometres long. Since, however, they flow through soils that are rich in salts, flood or seepage water from them is more or less brackish and the Anopheline population consists chiefly of race *atroparvus*, van Thiel, in association with *messeae*. Malaria in the former type of valley seems to be less intense and less severe than in the latter. In the group of hills in the centre of the northern part of Moldavia, pure populations of race *maculipennis* are found in the higher parts, which are still wooded; lower down, in the valleys bordered by these heights, *messeae* becomes abundant and *atroparvus* is sometimes found.

The plateaux and plains between the large rivers in Moldavia and Bessarabia are often arid, and the breeding places of Anopheline larvae are much restricted. The rain-water and springs wash the soil from the deforested hills and plateaux, and the beds of the small rivers in the plains are gradually raised, so that the drainage slope is more and more reduced and the water spreads everywhere. Large patches of salty soil are scattered almost throughout the region. As a result of this combination of factors, *messeae*, *maculipennis* and *atroparvus* occur together, *messeae* and *maculipennis* predominating towards the north and *atroparvus* towards the south. Malaria, which is widespread and severe, is connected with the permanent presence and often the predominance of *atroparvus*. The same type of malaria is found in Wallachia in the land between the large rivers from the sub-Carpathian hills to the Danube flood zone. Most of the land is salty on or just below the surface, and, owing to the excessively continental climate, the water collections evaporate until they become small pools of saline water. This results in the general distribution of race *atroparvus* in addition to the other two races. The breeding places in which *messeae* and *maculipennis* predominate in wet years may harbour *atroparvus* in dry years; the latter may also replace the two former when a dry summer follows a wet spring.

The Dobrogean plateau is very bare, particularly in the central and southern sections, there are hardly any water-courses, and the water

collections and even the deep wells are generally brackish. At the edge of the sea are a number of permanent brackish lakes, most of which were once marine lagoons. Race *atroparvus* occurs in almost pure populations, mixed here and there with *maculipennis* and *messeae*; it is only towards the north and west of the plateau along the Danube that collections of fresh water are found and *messeae* appears in higher proportions. On the coast these races are accompanied by *sacharovi*, Favr. In 1937, *sacharovi* comprised 60 per cent. of all the races found in dwellings, and it appears to be the chief vector in the region, closely followed by *atroparvus*. Malaria is distributed over the whole plateau, but is more intense and severe on the coast than elsewhere in the country.

GALLIARD (H.). *Sur la biologie des culicidés du genre Mansonia R. Blanchard en Indochine*.—*Ann. Parasit. hum. comp.* **17** no. 3 pp. 177-186, 2 pls., 1 fig., 14 refs. Paris, 1939.

Much of the information contained in this paper on the plants with which the oviposition, larvae and pupae of mosquitos of the subgenus *Mansonioides* are associated in Indo-China has already been noticed [cf. *R.A.E.*, B **25** 233]. The three species of this subgenus found in Indo-China are *Mansonia uniformis*, Theo., *M. indiana*, Edw., and *M. annulifera*, Theo., and the studies were made on the last two. The author points out that *M. annulifera* was erroneously recorded as *M. annulipes* in the paper referred to [and hence as *M. longipalpis*, Wulp (*annulipes*, Wlk.) in the abstract of it]. He also states that, in the laboratory, development from egg to adult was never obtained, and that the larvae that completed their development [*loc. cit.*] were collected, in the third instar, from natural breeding places. In a certain number of cases, pupae and adults were obtained from fourth-instar larvae of *M. indiana* kept in distilled water containing no vegetation, so that in certain circumstances air can be obtained at the surface of the water. Adults emerged from these free pupae in 3-4 days, while those from pupae attached to plants in the normal way emerged in 3 days. The respiratory structures of the free-floating pupae did not differ from those of pupae that attach themselves to plants.

In Tonkin, *M. indiana* seems clearly to predominate, whereas *M. uniformis*, which is the only species known in the adjoining Chinese provinces, is rare. In Cochin China, *M. indiana* is absent, *M. uniformis* is very common and *M. annulifera* is considered to be rare, although it is definitely more abundant in Cambodia than the other two species.

The author considers that differences of opinion as to the species of plant preferred for oviposition and for the attachment of the larvae and pupae [cf. **25** 195; **27** 45] are explained by the latitude in which observations were made, for in Tonkin, the larvae prefer to attach themselves to *Eichhornia crassipes* and eggs are laid chiefly on the submerged portions of the leaves of *Salvinia natans*, whereas in the south (Cochin China and Cambodia), larvae and eggs are more often associated with *Pistia stratiotes*.

GALLIARD (H.). *Culicidés du Yunnan (Chine)*.—*Ann. Parasit. hum. comp.* **17** no. 3 p. 261. Paris, 1939.

Culex theileri, Theo., was found to be common near Yunnanfu, at an altitude of about 6,500 ft. It has not been recorded elsewhere in

China. It bred in rice-fields and pools containing *Eichhornia* and in artificial water collections such as fountains, holes in rocks and receptacles containing more or less polluted water. *C. fatigans*, Wied., was found in the same locality. The record is interesting since the latitude of Yunnanfu is about 25°N., and even in the low and warm coastal regions of China *C. fatigans* does not occur further north than 30°N. This species is domestic in Tonkin, but ubiquitous in Yunnan, where it is found in rice-fields and pools as well as in domestic breeding places.

TOUMANOFF (C.) & HOANG-TICH-TRY. *Au sujet de la concordance entre l'indice gamétique et le pourcentage des moustiques infectés dans la zone à minimus au Tonkin.—Rev. méd. franç. Extr.-Orient*
17 no. 3 pp. 280-284. Hanoi, 1939.

Using data collected by the Anti-malaria Service of Hanoi and by themselves during 1937-38, the authors compare the average natural infection rates in *Anopheles minimus*, Theo., in groups of localities in which the gametocyte indices were below 10 or varied from 10 to 20, 20 to 30, 30 to 40 or were above 40. In these groups, the average infection rates were 4.51, 4.84, 5.27, 5.55 and 7.66 per cent., respectively. Thus an increase in the gametocyte index gives rise, in general, to an increase in the infection rate, but an infection rate of 1-2 per cent. is considered sufficient to ensure the effective transmission of the disease. As the infection rate in localities with the lowest gametocyte rates was more than 4 per cent., a reduction of the gametocyte rate by means of drugs from 40 to less than 10 would result in a negligible decrease in the infection rate. It is concluded that anti-malaria measures should not be confined to the administration of drugs, but that steps should first be taken to reduce to a minimum the contact between the malaria vector and man by means of anti-larval measures.

ESAKI (T.). *Arthropoda injurious to Man in Mandated South Sea Islands of Japan. (1st Report.) [In Japanese.]—Vol. Jub. Prof. S. Yoshida* **1** pp. 230-252. Osaka, Osaka nat. Hist. Soc., 1939.

Brief notes are given on the bionomics of Arthropods that attack man in the Pacific islands under Japanese mandate. *Aëdes aegypti*, L., *A. albopictus*, Skuse, and *Culex fatigans*, Wied. (*quinquefasciatus*, auct.) are common, but no Anopheline has been recorded from the islands. The larvae of a species of *Aëdes* were found in water in leaves of a pitcher-plant (*Nepenthes*) on Palau and Koror. Other blood-sucking insects include *Culicoides* sp., *C. peliliouensis*, Tokunaga [*cf. R.A.E.*, B **25** 154], *Cimex hemiptera*, F., and *Pulex irritans*, L., which is very scarce, while an Oedemerid, *Eobia cinereipennis ogasawarensis*, Mats., causes blisters on the skin [**27** 143]. A mite of the genus *Trombicula* that is common in sandy places on coral islands, especially in groves of palms and *Artocarpus* after rains, sucks blood, but does not transmit disease.

YOKOGAWA (S.). *The Spread of *Wuchereria bancrofti* and its Relationship to the Human Flea, *Pulex irritans*.—Vol. Jub. Prof. S. Yoshida* **2** pp. 285-290. Osaka, Osaka nat. Hist. Soc., 1939.

Filaria (Wuchereria) bancrofti undergoes a complete developmental cycle in mosquitos, especially in *Culex fatigans*, Wied., but the

occurrence of endemic filariasis does not always correspond to the distribution of *C. fatigans* [cf. R.A.E., B 27 177]. An examination was therefore made of 891 examples of *Pulex irritans*, L., collected in the Loochoo Islands from houses of people heavily infected with microfilariae of *F. bancrofti*. Though the microfilariae were found in the mid-gut of the flea and exsheathment occurred with the clotting of the blood, they did not develop further. It is concluded that *P. irritans* is not concerned in the spread of filariasis.

OMORI (N.). Transmission Experiments of Relapsing Fever Spirochaete by the Agency of Tropical Rat Mite. [In Japanese.]—*J. med. Ass. Formosa* 38 no. 6 pp. 899-922. Taihoku, 1939. (With a Summary in English.)

An account is given of experiments on the transmission of *Spirochaeta duttoni* from mouse to mouse by *Liponyssus nagayoi*, Yamada [cf. R.A.E., B 27 128], carried out at Taihoku, Formosa, where relapsing fever in man has not been recorded. The spirochaete was transmitted to the mice by ingestion of mites or by rubbing them on the shaven skin, but not by the bites of the mites or by the intraperitoneal inoculation of faeces or eggs of heavily infected females. The spirochaetes were abundant in the mites on the day of the infecting feed, but their numbers decreased very rapidly. None could be found after 16 days, but the mites remained infective for 33 days. It is considered that the mite could play a part in the transmission of spirochaetes from man to man.

SCHWARDT (H. H.). Biologies of Arkansas Rice Field Mosquitoes.—
Bull. Arkansas agric. Exp. Sta. no. 377, 22 pp., 5 figs., 8 refs.
 Fayetteville, Ark., 1939.

The rice-growing region in the south-eastern part of Arkansas suffers annually from a plague of mosquitos, which are abundant approximately from the beginning of June to the middle of September. About 90 per cent. are *Psorophora columbiae*, D. & K., the remaining 10 per cent. including *Anopheles quadrimaculatus*, Say, *P. ciliata*, F., and *P. discolor*, Coq. Notes are given on characters of the eggs, larvae and adults of *P. columbiae*, *P. ciliata* and *P. cyanescens*, Coq., which is a pest in many parts of Arkansas other than the rice region, and on their bionomics, based on studies made both in the field and in the laboratory. The eggs of species of this genus are deposited on the ground in dry depressions and hatch when these become filled with water. The methods of collecting, transporting and rearing the mosquitos are described. It was found that a relatively small proportion of the mosquitos was derived from the rice-fields. The frequent alternations between wetness and dryness on which the breeding of *P. columbiae* is dependent are characteristic, not of the rice-fields themselves, but of the seepage puddles, roadside and drainage ditches, and natural depressions of the soil outside the fields. The bottoms and sides of the ditches and of the irrigation canals are, in general, left undisturbed from season to season, so that eggs deposited there are not harmed, whereas overwintering eggs in rice-fields, which are probably deposited after the pre-harvest drainage, are apparently killed or buried by the disturbance of the soil during the

planting of the new crop. Moreover, the ditches and depressions are flooded and drained much more frequently than the rice-fields and may therefore give rise to a succession of broods during the season. Water does not usually stand in them long enough for aquatic predators to become abundant as they do in rice-fields. The fact that mosquitos are more numerous after heavy rains and during rainy seasons and are noticeably scarce during years of drought also suggests that they breed outside rice-fields, since the methods of watering rice are much the same over a period of years. Regular observations made at several breeding places during four summers showed that the various species of *Psorophora* studied do not hatch at the same time, even when the eggs are present in the same pool.

Various experiments with a miscible oil and a pyrethrum emulsion were carried out on rice-plots, and although these materials cannot at present be recommended for the control of the larvae, since the cost is too great, the tests showed that effective larvicides can be applied without injuring the rice. The miscible oil appears to be particularly suitable for treating rice-fields, as when added to water entering the plot, it mixes with the entire volume and rises to the surface to form a film after the water ceases to flow. The experiments also showed that draining and re-flooding does not invariably lead to the production of a brood of mosquitos, so that at least some fields do not need treatment. Since, however, most of the mosquitos breed outside the rice-fields, the area to be treated is relatively small and control appears to be practicable. Various suggestions regarding the oiling that would be necessary are given.

STEWART (M. A.). **A new Prophylaxis for Wound Myiasis in domestic Animals.**—*J. econ. Ent.* **32** no. 3 pp. 404–407, 5 refs. Menasha, Wis., 1939.

The experiments described were undertaken with a view to finding a dressing that would prevent wounds in domestic animals from becoming infested with blowfly larvae in the parts of California in which high temperatures and low humidities prevail during the periods of maximum fly activity and dressing with acid-free, dehydrated pine-tar oil [cf. *R.A.E.*, B **24** 5; **25** 54] has not proved highly effective. Several dressings were tested on wounds on cattle caused by dehorning because they are the most difficult to protect.

The following is substantially the author's summary : The mixture that afforded the most efficient protection was composed of 25 per cent. acid-free, dehydrated Stockholm pine-tar oil with a specific gravity of 1.075, 12.5 per cent. amorphous paraffin wax with a U.S.P. melting point of from 160 to 170°F., and 62.5 per cent. viscous oil with the following specifications : flash point Cleveland 540°F. maximum, viscosity at 100°F. Saybolt universal 144,200, viscosity at 210°F. Saybolt universal 2,900–3,200, pour point +50°F. maximum, colour A.S.T.M. 2.0 maximum, carbon Conradson 0.5 per cent. maximum, sulphur bomb 0.5 per cent. maximum, and Sligh test 1.0 maximum. It should be applied to wounds, over an oakum substratum when a sinus is present, and when a sinus is not present, after the wound has been dried by the application of motor ether or tannic acid. It greatly stimulates tissue repair in wounds and drainage is not inhibited. Its prophylactic efficiency is based upon both a chemical repellent and a mechanical barrier.

AITKEN (T. H. G.). A Contribution to the Knowledge of the Mosquitoes of Owens Valley, Inyo County, Calif.—*J. econ. Ent.* **32 no. 3 pp. 407-412, 4 refs. Menasha, Wis., 1939.**

The seven species of mosquitos collected in or near Owens Valley, Inyo County, California, included *Anopheles maculipennis*, Mg., *A. punctipennis*, Say, and *A. pseudopunctipennis*, Theo. Records of the California State Department of Health, dating from 1914, show that no case of malaria has been reported from this County.

BUSHLAND (R. C.). Volatile Oils as Ovicides for the Screwworm, *Cochliomyia americana* C. & P.—*J. econ. Ent.* **32 no. 3 pp. 430-431, 2 refs. Menasha, Wis., 1939.**

Since it had been found that oil of wormseed destroyed the eggs of *Cochliomyia hominivorax*, Coq. (*americana*, Cush. & Patt.), tests were carried out in Texas with 37 other volatile oils against eggs less than three hours old and eggs that were within two hours of hatching. Oils of aniseed, bitter almond, cassia, fennel seed, mustard, parsley, pennyroyal, rue, sassafras and sweet birch killed all the eggs in the two classes. Oils of caraway seed, clove and lemon grass killed the younger eggs, and although they did not entirely prevent the hatching of the older ones, they caused the death of the larvae almost immediately after hatching. Sixteen other oils were completely effective against the younger eggs, but did not kill high percentages of the older ones.

FISK (F. W.). New Mosquito Records from Key West, Fla.—*J. econ. Ent.* **32 no. 3 p. 469. Menasha, Wis., 1939.**

Culex bahamensis, D. & K., a mosquito hitherto known only from certain islands of the West Indies, has been found to be fairly common on Key West, Florida. Larvae of this species were first discovered in an abandoned cistern containing brackish water in association with those of *Anopheles atropos*, D. & K. The discovery of *A. atropos* is interesting since it is the first Anopheline recorded from this island since the discovery and apparent eradication of *A. albimanus*, Wied., in 1904. Only one other breeding place of this species has been discovered, and no adults have been taken.

MURRAY (D. R. P.). Problems concerning the Efficiency of Oils as Mosquito Larvicides.—II. The Spreading Power of Oils and Methods of increasing it.—*Bull. ent. Res.* **30 pt. 2 pp. 211-236, 12 refs. London, 1939.**

The following is the author's summary of this paper, in which are described further investigations on the properties of oils that influence their effectiveness as mosquito larvicides [*cf. R.A.E.*, B **26** 135]: A method is described of using the Adam-Langmuir surface pressure trough for the direct measurement of the spreading power of oils against surface contamination. Pure higher paraffins are non-spreading, and pure aromatics have only a small spreading pressure. Commercial grades of oils owe what spreading pressure they have to impurities which are only present in small quantities and can be removed. The spreading power of oil is greatly increased by irradiation of very thin layers of the oil. Even so, only a small fraction undergoes chemical

change, the great bulk being recoverable with its original properties. Straight chain fatty acids and alcohols only raise the spreading pressure of clean oil to a figure which is often already reached in a cruder product. There is some evidence, however, that a simple group such as —OH can produce a high pressure if attached to the right hydrocarbon framework. Of the substances investigated, the ones producing the greatest effect were the products of combined polymerisation and oxidation of olefinic hydrocarbons (cracked spirit gum) and the products of sulphonation of oils. Substances soluble in water do not form good spread-aiders, because they dissolve out of the oil, which then contracts again if there is resistance to its spread. The maximum spreading pressure exerted by a substance in oil solution is greater in paraffin than in aromatic oils. When oil is shaken with a solvent which separates aromatics from paraffins, the spreading constituents, whether naturally occurring or added, pass into the aromatic fraction. Strong concentrates can be obtained in this way, and methods can be easily devised for transferring the active materials from one oil to another. The spreading constituents can be entirely removed from oil by filtering it through fuller's earth.

BRETT (G. A.). On the Period of Survival of the Egg, Larva, and first Nymph Stages of the Argasid Tick *Ornithodoros moubata*, Murray, at different Relative Humidities.—*Bull. ent. Res.* **30** pt. 2 pp. 247–253, 13 refs. London, 1939.

In the investigations described, 8 batches of eggs of *Ornithodoros moubata*, Murr., were exposed to 8 different relative humidities ranging from 80 to 6·2 per cent. in an incubator in which the temperature normally fluctuated between 23·8 and 24·4°C. [74·8 and 75·9°F.], and were examined about twice a week to determine the mortality and stage of development. At 80 and 70 per cent. humidity, all the eggs gave rise to first-stage nymphs; the percentages dying as eggs and larvae rose gradually from 2 and 2, respectively, at both 60 and 50 per cent. to 67 and 20, respectively, at 6·2 per cent. The average periods of development at all humidities were 10–11 days up to the larval stage and 17–18 up to the first nymphal stage. At 80 per cent. humidity, at least 41 out of 45 first-stage nymphs were alive on the 202nd day, when the experiment was terminated; none had been fed. Thus, high humidities appear to be most favourable, but even at very low humidities a sufficient proportion of first-stage nymphs developed to carry on the race. This stage is more resistant to desiccation than the earlier stages, it is ready to feed and can, in nature, move to a more favourable microclimate. It is suggested that the reason why certain field workers have considered high humidities unfavourable is that they have not taken into account that the humidity of the microclimate of the harbourage occupied by the tick is probably much higher than that of the surrounding atmosphere.

WILSON (S. G.). A Note on the Fly Areas of North Nyasa District.—*Bull. ent. Res.* **30** pt. 2 pp. 255–258, 2 maps, 3 refs. London, 1939.

In the part of the lake plain north of Karonga Boma in the North Nyasa district, reported outbreaks of bovine trypanosomiasis due to *Trypanosoma congolense* have increased in recent years, and one

suspected case of sleeping sickness was notified in 1937. Since tsetse flies were supposed to be absent, surveys were carried out in the area in May-June 1937 and in September 1938. The distribution of *Glossina brevipalpis*, Newst., the only species of tsetse fly encountered, is described and compared with that recorded by M. Sanderson in 1911. At present, it occurs during the dry season (April-December) in a narrow continuous belt along the foothills bounding the lake plain on the west from Katumbe village in the south round the Yembe Hills and along the Songwe valley from the Chungu River as far west as the Nantakwa River. The presence of fly in North Nyasa south of Karonga Boma has never been suspected. *G. brevipalpis* lurks during the day in the recesses of thickets and feeds only at dusk or after dark, and it is probably for this reason that the records for this fly-belt are so scanty and that the fly has apparently existed for years near the villages in the Songwe valley without the natives being aware of its presence. Its absence from the lake plain itself has resulted from a combination of factors. Intensive cultivation of river banks for the growing of native crops (cotton in the dry months and rice in the wet season), the increase of the cattle population to the point of overstocking, and grass-burning have all combined to produce vegetative conditions inimical to the fly. The fly area along the Songwe River is almost entirely uninhabited west of the Chungu River, and the soils on the foothills at Yembe and to a lesser extent at Katumbe are unsuitable for cotton cultivation. Prolonged search for fly at Katumbe village during the dry season was unsuccessful, but individuals were sent in by natives during the rains. However, the dependence of this species on deep shade would limit its spread during the wet season, although native evidence supports the assumption that density increases within the fly belt with the increase in humidity.

NASH (T. A. M.). **The Ecology of the Puparium of *Glossina* in Northern Nigeria.**—*Bull. ent. Res.* **30** pt. 2 pp. 259-284, 3 pls., 6 figs., 9 refs. London, 1939.

A detailed account is given of investigations on the density and mortality of pupae of *Glossina* in relation to the microclimatic conditions in the breeding grounds, carried out from September 1936 to October 1938 near Gadau, Northern Nigeria, where only *G. morsitans*, Westw. [race *submorsitans*, Newst.] and *G. tachinoides*, Westw., occur. Some of the information has already been noticed [*R.A.E.*, B **27** 201].

The following is taken from the author's summary: Larvae are deposited on soils ranging from fairly heavy clay to coarse sand, and the presence or absence of organic matter seems to be immaterial. The soil temperature varies greatly in different breeding grounds in the dry season but little in the rains. The soil moisture varies greatly in the rains, but little in the dry season, when it falls so low in some breeding grounds that the atmosphere in them must be below saturation. Evaporation measured at 5 ins. above ground level varies little from site to site, but important differences occur at greater heights where the screening effects of thicket become operative. The seasonal changes are so great at Gadau that no one breeding ground can satisfy requirements throughout the year. The breeding of *G. morsitans* occurs in the early dry season in small thickets in the open woodland and in the more open parts of the forest islands, at the beginning of the very hot weather only in the densest parts of the

forest islands, in the early rains in the open woodland, and in the heavy rains only under palm seedlings and logs in the woodland. This cycle fits closely the cycle for the seasonal concentration and dispersal of the adult population. The chief breeding ground of *G. tachinoides* in the wet season is unknown, but breeding also occurs under logs and palms; the rest of the cycle has already been dealt with [*loc. cit.*]. It seems that in very wet years *G. morsitans* and probably *G. tachinoides* stop breeding for a month towards the end of the heavy rains, possibly owing to an almost saturated atmosphere. After a wet season of low rainfall, when there has been no cessation of breeding, the density of the pupae in the dry season is much greater. In general the mortality is high during the dry season and low throughout the wet. A detailed account is given of the seasonal fluctuations in mortality among the pupae in the different breeding sites and its probable connection with variations in the temperature and humidity of the soil.

METCALF (C. L.) & FLINT (W. P.). **Destructive and Useful Insects. Their Habits and Control.**—2nd edn. (revised), Med. 8vo, xvi+981 pp., 584 figs. London, McGraw-Hill Pub. Co., Ltd., 1939. Price £2 10s.

This new edition of a valuable text-book already noticed [R.A.E., A 17 29; B 17 19] has been revised and enlarged to include the results of recent research and data on Arthropods that have recently become pests in the United States. A considerable rearrangement of the material within the chapters in the latter half of the book has been made in order that a more logical plan may be followed throughout. Series of numbers allotted to the Arthropods or groups of Arthropods facilitate cross-reference when information on them occurs in various parts of the book.

MARCHOUX (E.) & CHORINE (V.). **Transmission de la lèpre par les poux et par les Laelaps.**—*Bull. Soc. Path. exot.* 32 no. 5 pp. 477-479, 3 refs. Paris, 1939.

The authors describe experiments carried out in 1912, 1913 and 1934 with *Polyplax (Haematopinus) spinulosa*, Burm., and *Echinolaelaps (Laelaps) echidninus*, Berl., in which healthy rats were infected with leprosy by inoculation of suspensions of lice [cf. R.A.E., B 18 93] or mites from infected rats but not of mites from uninfected ones, though these mites were found to harbour three types of acid-resistant bacilli. It was shown that the leprosy bacillus survived in the mites for at least three days. Lice and mites do not apparently transmit the disease by their bites, though animals may possibly be infected by eating them.

ROUBAUD (E.) & COLAS-BELCOUR (J.). **Des conditions expérimentales de la fertilisation et de la ponte chez l'Aëdes geniculatus.**—*Bull. Soc. Path. exot.* 32 no. 5 pp. 502-505, 3 refs. Paris, 1939.

The authors describe in detail the manner in which they induced pairing and the deposition of fertile eggs by *Aëdes geniculatus*, Ol., reared in the laboratory at a time of year (January) when adults of this species are not present in nature. The necessary conditions

appear to be a free space of at least $3\frac{1}{2}$ cu. ft., fairly bright natural or artificial light coming from above and a rather high degree of humidity. The females did not receive a blood meal until after they had paired.

TOUMANOFF (C.). Les races géographiques de *St. fasciata* et *St. albopicta* et leur intercroisement.—*Bull. Soc. Path. exot.* **32** no. 5 pp. 505-509. Paris, 1939.

An account is given of further experiments in Tonkin on the cross-breeding of *Aëdes (Stegomyia) aegypti*, L. (*fasciatus*, F.) and *A. (S.) albopictus*, Skuse [cf. *R.A.E.*, B **27** 47], using, in addition to strains from Hanoi, strains of both species from Saigon and a strain of *A. aegypti* from Calcutta. From the negative results of experiments with males and females of *A. aegypti* from Calcutta and females and males of *A. albopictus* from Hanoi carried out both in winter and summer, it is concluded that cross-breeding between species of *Aëdes* from places widely separated geographically is difficult, if not impossible, to obtain. On the other hand, two out of four experiments with the strains from the north and south of Indo-China, using females of *A. albopictus* and males of *A. aegypti*, were successful, the progeny in both cases resembling *A. albopictus*. It is suggested that the strains occurring in Tonkin and Cochin China may have become mixed owing to transport of mosquitos by land or sea.

SENEVET (G.) & ETHES (Y.). Quelques anophèles du Soudan Français.—*Bull. Soc. Path. exot.* **32** no. 5 pp. 509-511, 1 fig., 5 refs. Paris, 1939.

This paper includes a list of Anophelines collected near Segu in the French Sudan in 1938-39; they comprised *Anopheles gambiae*, Giles, *A. funestus*, Giles, *A. coustani* var. *ziemanni*, Grünb., *A. rufipes*, Gough, *A. pharoensis*, Theo., and *A. squamosus*, Theo.

HOANG-TICH-TRY. Essai de croisement de *St. albopicta* ♀ et de *St. fasciata* ♂, en espace restreint.—*Bull. Soc. Path. exot.* **32** no. 5 pp. 511-513. Paris, 1939.

The experiments described show that cross-breeding of males of *Aëdes (Stegomyia) aegypti*, L. (*fasciatus*, F.) with females of *A. (S.) albopictus*, Skuse, both reared from larvae taken at Hanoi, is possible when the sexes are paired in small cages ($15 \times 9 \times 4$ cm.) as well as in larger ones and even at a time of year that is unfavourable [cf. *R.A.E.*, B **27** 47]. The progeny resembled *A. albopictus*.

SICÉ (A.) & TORRESI (F.). Répartition de la trypanosomiase humaine au Soudan Français.—*Bull. Soc. Path. exot.* **32** no. 5 pp. 560-565, 1 fldg map, 3 refs. Paris, 1939.

This paper deals with investigations on the distribution of sleeping sickness in the French Sudan. The disease was found to be present in the southern parts of the colony, where the hot dry climate of the western Sahara is tempered from June to October by relatively abundant rains, which raise the humidity, augment the volume of water in the rivers, enable the vegetation on the river banks to resume growth, and permit an increase in the density of undergrowth and thickets. At this time, also, the temperature is not excessive, so that

conditions are favourable for the breeding and activity of tsetse flies (*Glossina*), which, coming into contact with man, spread the infection. The flies taken in the basins of the Bani and the Black Volta belonged chiefly to the hygrophilous species. During the dry season as well as during the rains, *G. tachinoides*, Westw., was the most abundant. In the dry season, it was found only in the undergrowth that covers the edges of water-courses, but in the wet season it extends its range of activity and may appear in villages several hundred yards from a river. *G. palpalis*, R.-D., was taken less frequently and *G. morsitans*, Westw., was rarer still. Of the flies caught in the same river basins from June to November, 90·5 per cent. were *G. tachinoides* and 9·5 per cent. were *G. morsitans submorsitans*, Newst., which was not observed during the dry season. In all seasons the number of males taken was always higher than the number of females.

HERR (A.) & BRUMPT (L.). **Un cas aigu de maladie de Chagas contractée accidentellement au contact de triatomes mexicains: observation et courbe fébrile.**—*Bull. Soc. Path. exot.* **32** no. 5 pp. 565-571, 1 fig. Paris, 1939.

Details are given of an acute case of Chagas' disease in one of the authors, who was infected in the course of an experiment in Paris, in which excreta of *Triatoma pallidipennis*, Stål, containing metacyclic forms of *Trypanosoma cruzi* came accidentally into contact with the eye. The infected bugs had come from Mexico (Colima), where 6 cases of Chagas' disease, which was unknown up to 1938, were discovered in 1939. They had been taken far from dwellings in the burrows of a wood rat, *Neotoma (Hodomys) alleni*, a finding which shows that a wild strain of *T. cruzi* may be immediately pathogenic for man. Trypanosomes were never found in the blood, but xenodiagnosis [cf. *R.A.E.*, B **3** 56], carried out with nymphs of *Rhodnius prolixus*, Stål, and *Triatoma infestans*, Klug, was positive after 37 days.

ZOTTNER (G.) & COSTE (E.). **L'hypoderbose équine au Maroc.**—*Bull. Soc. Path. exot.* **32** no. 5 pp. 571-576. Paris, 1939. **Evolution compléte d'*Hypoderma bovis* chez le cheval.**—*C. R. Soc. Biol.* **131** no. 20 pp. 907-908, 1 fig., 2 refs. Paris, 1939.

In the first paper, the authors discuss a number of cases of infestation of horses by *Hypoderma bovis*, DeG., observed by themselves and by other workers in Morocco during recent years. It is concluded that the warbles appear in winter, usually from November to March, and there is some evidence that they occur chiefly in horses that have not been well groomed, which suggests that careful grooming removes the eggs from the hairs on which they are laid. The fact that all larvae that had been examined were in the second instar had raised the question whether the development of *H. bovis* could be completed in the horse, but a larva taken from a horse and received for identification in February proved to be in the third (final) instar [cf. also *R.A.E.*, B **27** 238]. The authors suggest that the absence of mature larvae among the numbers observed may be explained by the fact that injuries caused by curry combs, brushes, harness, etc., kill the larvae, which are then expelled from the body of the horse in an immature stage by suppuration, as are other foreign bodies. At the period when the larvae may be removed from the warble simply by pressing

with the finger tips, the warble is surrounded by an oedematous patch about the size of a man's hand, and it is recommended that this sign should be awaited and the larvae expressed by hand.

The second paper gives some of the information contained in the first.

McCULLOCH (R. N.). Economy in Jetting Sheep. Re-use the waste Jetting Mixture. Protect the Operator.—*Agric. Gaz. N.S.W.* 50 pt. 4 pp. 196-198, 3 figs. Sydney, 1939.

When sheep are jetted in the crutch area against blowflies, some of the liquid splashes out immediately and some drains away fairly rapidly. Attempts have been made in New South Wales to collect and use this material again in order to economise in jetting mixture and in water (an important consideration where it has to be transported) and to prevent the accumulation of large quantities of waste arsenic in yards. The sodium arsenite solution [cf. *R.A.E.*, B 22 17] may be used repeatedly without loss of effectiveness until it becomes too dirty. On the other hand, with the calcium arsenite mixture [cf. 22 124; 24 39], which gives better protection, part of the suspended material remains on the jetted wool and the arsenical content of the liquid that drains off is consequently lowered. Analysis of 12 samples of waste fluid collected from trays placed under jetting races [cf. 25 211] showed that their arsenic content was reduced by 10-20 per cent. Thus, since the original material contains 1 per cent. arsenic, the used material contains 0.8 per cent., and a mixture of equal parts of new and used material contains 0.9 per cent. This mixture gave protection as good as that afforded by clean newly mixed spray when tested in the field. The routine evolved for making and using such a mixture in practice is described. The cost of jetting when waste material is used over again is reduced to $\frac{1}{3}$ d. per head [cf. 24 39] and the amount of water is kept down to $\frac{1}{6}$ gal. per sheep.

For the protection of persons jetting the sheep, the author suggests rubber gloves, roughly made sleeves of light water-proof material, and for the face a sheet of light gauge aluminium (13 by 8 ins.) attached to the brim of a hat, with a rectangular opening (8 by 2 ins.) opposite the eyes, which are protected by a sheet of colourless celluloid clipped on the inside of the opening. The strips of celluloid are changed when dirty and washed later. Rubber thigh boots give protection from burrs as well as the mixture when a ground-level race is used, but in a raised race [25 211], a canvas apron attached to the race and supported on a stiff wire that enables it to be bent into any required position protects the operator's body and keeps the ground dry by directing all splash into the iron tray beneath the race.

Investigaciones sobre dipteros argentinos. I. Miasis.—*Publ. Misión Estud. Pat. reg. argent. Jujuy* no. 41 pp. 1-86, 1 pl., 78 figs. Buenos Aires, 1939.

The following are summaries of the papers in this series.

Mazza (S.) & Jörg (M. E.). *Cochliomyia hominivorax=americana* C. & P. Estudio de sus larvas y consideraciones sobre miasis, pp. 1-46, 38 figs., 1 pl., 7 refs. The authors review the literature on the confusion of *Cochliomyia hominivorax*, Coq., and *C. macellaria*, F. [*R.A.E.*, B 23 11; 27 2] and give a list of papers published from 1858 to 1938 on the former and the myiasis that it causes. All stages of the fly are described in detail, with notes from the literature on its

life-history and the attractiveness to it of wounds. In the authors' observations in Argentina, carcasses exposed in the open air in a locality in which *C. hominivorax* was present became infested by *C. macellaria* and, in smaller numbers, by *Musca domestica*, L., and species of *Sarcophaga* and *Lucilia*, but not by *C. hominivorax*. *C. macellaria* was not involved in numerous cases of myiasis in man and animals. A list is given of flies that cause human and animal myiasis in Argentina. The technique for making microscopic preparations of the larvae is described, and the various remedies used in the treatment of myiasis due to *C. hominivorax* are briefly discussed.

Mazza (S.) & Basso (P.). Miasis de úlcera crónica de pierna por *Sarcophaga barbata* y *Cochliomyia hominivorax*, pp. 47-54, 12 figs. This is the first record for Argentina of myiasis caused by *Sarcophaga barbata*, Thomson, numerous larvae of which, together with those of *C. hominivorax*, were found infesting an unprotected, suppurating ulcer on the leg of a labourer. The larva is briefly described.

Basso (R.). Frecuencia y naturaleza de las miasis en Mendoza, pp. 55-65, 5 figs. Data on 197 cases of myiasis in man recorded in the province of Mendoza in 1920-35 are given in a table, and 11 cases, of which 8 were nasal, are described. They were due to *C. hominivorax*, alone or associated with *S. barbata*.

Mazza (S.) & Reyes Oribe (H.). Miasis urinaria por *Fannia fusconotata* Rondani en Formosa, pp. 66-69, 2 figs. A description is given of a larva of a species of *Fannia*, probably *F. fusconotata*, Rond., voided in urine by a soldier in the territory of Formosa.

Mazza (S.) & Reyes Oribe (H.). Miasis furunculosa por *Cochliomyia hominivorax* (Coquerel), pp. 70-75, 8 figs. This is a note of a case of dorsal furuncular myiasis in the territory of Formosa due to larvae of *C. hominivorax*, one specimen of which is described.

Jörg (M. E.). Miasis de úlcera por *Calliphora vomitoria*, pp. 76-77, 1 fig. *Calliphora vomitoria*, L., was bred from prepupae taken from an anal ulceration in a patient in Buenos Aires. Notes are given on the bionomics of this fly.

Mazza (S.) & Cornejo (A.). Consideraciones sobre miasis observadas en la provincia de Salta, pp. 78-86, 12 figs. Brief notes are given on 44 cases of myiasis that occurred during 1928-38 in the Province of Salta. Of the 21 in which the site of infestation was recorded, 11 were nasal, and of cases in which the fly concerned was identified, 10 were due to *C. hominivorax*, and one, a case of anal myiasis, to *S. barbata*.

LESTER (H. M. O.). Certain Aspects of Trypanosomiasis in some African Dependencies.—*Trans. R. Soc. trop. Med. Hyg.* **33** no. 1 pp. 11-25. London, 1939.

The author surveys the position regarding sleeping sickness and *Glossina*, the research work that has been or is being carried out on this subject, and the measures that are being undertaken for the control of the disease in Tanganyika Territory, Uganda, Kenya, the Anglo-Egyptian Sudan and Nigeria.

CORSON (J. F.). The Infections produced in Sheep and Antelopes by a Strain of *Trypanosoma rhodesiense*.—*Trans. R. Soc. trop. Med. Hyg.* **33** no. 1 pp. 37-46. London, 1939.

The author comments on the work carried out from 1934 to 1939 on a strain of *Trypanosoma rhodesiense* cyclically transmitted by

Glossina morsitans, Westw., to sheep, antelopes and man [R.A.E., B 27 142, etc.]. All sheep seemed to remain infected until they died, apparently of trypanosomiasis. Antelopes varied considerably in their resistance to infection. It may, however, be said that all infected animals remained infected long enough for the trypanosomes to be transmitted many times by fly if the animals had been living under natural conditions in a tsetse-fly area. On the whole, the virulence of the strain for sheep did not seem to be less in 1938 than it was in 1934. The hitherto unpublished negative results obtained with a volunteer bitten by a fly that had previously infected two reedbuck are described. Some details of the infections of the sheep and antelopes are given in tables.

STRICKLAND (C.), SEN GUPTA (S. C.) & MAZUMDAR (P. C.). **Further Observations on the Seasonal Infectivity of Mosquitoes as determined by a Study of the Incidence of Infantile Malaria.**—*Trans. R. Soc. trop. Med. Hyg.* 33 no. 1 pp. 69-74, 3 refs. London, 1939.

Additional information on the infection of infants with malaria was obtained from tea estates in the Bengal Duars during 1937-39 [cf. R.A.E., B 24 311]. From the combined data, it is concluded that every child born in this locality may develop mosquito-borne malaria within a year of birth, that inoculation by the Anopheline may occur in practically every month of the year, though the rate, which is similar in the hot weather (March to June) and the rains (July to October), appears to be rather lower in the cold weather (November to February), and that the average period before an infant develops malaria is practically the same among those born in the hot weather and in the rains but slightly longer among those born in the cold weather.

HAWKING (F.). **A new Focus of Onchocerciasis occurring in Kenya Colony.**—*Trans. R. Soc. trop. Med. Hyg.* 33 no. 1 pp. 95-106, 3 figs., 1 map, 9 refs. London, 1939.

In the course of this report on a focus of onchocercosis due to *Onchocerca volvulus* in the Kakamega district of Kenya Colony, the author states that ravines containing rapid streams with numerous small waterfalls that appear to be very suitable for the breeding of Simuliids are abundant in the region and that, after his visit in October 1938, examples of *Simulium neavei*, Roub., and *S. simplex*, Gibbins, were collected on the Isioka river near Kakamega.

POTTER (C.) & HOCKING (K. S.). **An Apparatus for Testing and Comparing the Biological Action of Insecticides on Flying Insects and a Method for Sampling the Concentration of the Atomized Insecticide.**—*Ann. appl. Biol.* 26 no. 2 pp. 348-364, 8 figs., 4 refs. London, 1939.

The following is the authors' summary : An apparatus and method for testing the effect of atomised sprays on flies and mosquitos are described. The apparatus consists of a revolving wire-gauze cage placed in a thermostatically controlled chamber, the whole of which may be easily cleaned and freed from toxic residues. The insecticide is sprayed into the chamber by means of an Aerograph MP gun and

distributed by means of a slow-moving fan. When the insecticide has been injected and an interval allowed for the initial rapid fall of concentration, the movement of the cage is stopped and the insects are introduced into it by means of a special tube and plunger. The time required for paralysis to take place is recorded. After a given interval, the insects are removed from the gauze cage and kept to ascertain the mortality. A technique for sampling the concentration of insecticide in the air space is described. The insecticide carrier is coloured with a dye, Sudan III for petroleum-oil bases and methylene blue for water bases. The percentage of atomised material remaining in the atmosphere at any given time is determined by aspirating a known quantity of the atmosphere of the chamber through a sintered glass filter. The dye is retained in the filter, it is washed out with a measured quantity of liquid and compared with known standards. Reasons are given for the assumptions that the dye molecules will behave in the same way as the insecticide molecules. This sampling method has been used to study the behaviour of a light oil, a heavy white oil and water at different degrees of atomisation. Tables and graphs are given which show that, except with a fine atomisation where most of the insecticide remains suspended for a considerable time, there is an initial rapid fall, which varies in amount with the degree of atomisation. This initial fall is followed by a much more gradual decrease of concentration. The experiments show clearly that oil bases of different physical properties cannot be compared adequately unless a sampling method is used to ascertain the quantities of material remaining suspended. Where water bases are used, it is shown that the time-concentration curve varies not only with the degree of atomisation, but also with the degree of saturation of the atmosphere before spraying. The concentration remains higher in an unsaturated atmosphere than in a saturated one.

A Handbook of Philippine Agriculture.—Fscap 8vo, v+803 pp., illus. [Laguna, P.I.] Coll. Agric. Univ. Philippines, 1939.

This handbook has been compiled for the use of farmers in the Philippines and contains information on a large number of miscellaneous subjects. The chapter on farm pests includes notes on the control of such household pests as cockroaches, mosquitos, bed-bugs, lice and fleas. The chapter on diseases of livestock includes notes on piroplasmosis, which is transmitted by ticks, and surra, which is transmitted by Tabanids, and on such pests of animals as flies, lice, ticks and mange mites.

MACLEOD (J.). The Ticks of Domestic Animals in Britain.—*Emp. J. exp. Agric.* 7 no. 26 pp. 97-110, 2 pls., 1 fig., 1 map. London, 1939.

This paper comprises brief notes on 12 of the 13 species of ticks that occur in the British Isles, and a detailed account of *Ixodes ricinus*, L., which is the only one known to be of economic importance and the information on which has been noticed from other sources [*cf. R.A.E.*, B 27 243, etc.]. *Haemaphysalis cinnabarinus punctata*, C. & F., the distribution of which is practically limited to the county of Kent, has been shown experimentally to be capable of transmitting

Piroplasma (Babesia) bovis to cattle in England, and on one farm in Dorset on which the disease occurred, the ticks were identified as this species.

PAPERS NOTICED BY TITLE ONLY.

TATTERSFIELD (F.). **Biological Methods of testing Insecticides. A Review.**—*Ann. appl. Biol.* **26** no. 2 pp. 365–384, 3½ pp. refs. London, 1939.

SMART (J.). **A Case of Human Myiasis due to Hypoderma [bovis, DeG., in Britain].**—*Parasitology* **31** no. 1 pp. 130–131, 7 refs. London, 1939.

THOMPSON (G. B.). **A Check-list and Host-list of the Ectoparasites recorded from British Birds and Mammals. Part I. Mammals (excluding Bats).**—*Trans. Soc. Brit. Ent.* **6** pt. 1 pp. 1–22. London, 1939.

VAN VOLKENBERG (H. L.). **An annotated Check List of the Parasites of Animals in Puerto Rico.**—*Circ. P. R. [fed.] Exp. Sta. Mayaguez* no. 22, 12 pp., 49 refs. Washington, D.C., 1939.

WATERMAN (J. A.). **Some Observations on the Habits and Life of the Common Scorpion [Tityus trinitatis, Pocock] of Trinidad.**—*Trans. R. Soc. trop. Med. Hyg.* **33** no. 1 pp. 113–118, 6 refs. London, 1939.

BRUMPT (E.). **Faits nouveaux concernant l'agent [Spirochaeta (Treponema) caratea] et l'épidémiologie du caraté ou mal del pinto de l'Amérique intertropicale.**—*Ann. Parasit. hum. comp.* **17** no. 3 pp. 245–256, 1 pl., 23 refs. Paris, 1939. [For shorter account see R.A.E., B **27** 195.]

LAAKE (E. W.). **Myiasis of Domestic Animals** [in the United States: a review].—*J. Amer. vet. med. Ass.* **95** no. 448 pp. 47–49, 6 refs. Chicago, Ill., 1939.

TOUMANOFF (C.). **Histoire des élevages au Tonkin de St. fasciata Theob., St. albopicta Skuse et de Culex fatigans Wied.** [An account of the rearing of *Aedes aegypti*, L., *A. albopictus*, Skuse, and *Culex fatigans*, Wied., in Tonkin.]—*Rev. méd. franq. Extr.-Orient* **17** no. 3 pp. 235–239. Hanoi, 1939. [Cf. R.A.E., B **27** 213.]

PARROT (L.). **Phlébotomes du Congo Belge. X. Description de Phlebotomus dureni ♂ et de Phlebotomus wansonii ♀.**—*Rev. Zool. Bot. Afr.* **32** no. 2 pp. 145–148, 3 figs., 4 refs. Brussels, 1939. [Cf. R.A.E., B **22** 119; **26** 224.]

PARROT (L.) & WANSON (M.). **Phlébotomes du Congo Belge. IX. Phlebotomus (Prophlebotomus) mirabilis n. sp.**—*Rev. Zool. Bot. Afr.* **32** no. 2 pp. 149–153, 4 figs., 1 ref. Brussels, 1939.

CORSON (J. F.). A Summary of the Work of the Research Scheme on
Trypanosoma rhodesiense during the Years 1930 to 1938.—*E. Afr.
med. J.* **16** no. 3 pp. 84-92, 3 pp. refs. Nairobi, 1939. [Cf.
R.A.E., B **27** 65, 266, etc.]

ITOH (H.). The Haemoflagellates of Insects.—*Vol. Jub. Prof. Yoshida*
2 pp. 81-90. Osaka, Osaka nat. Hist. Soc., 1939.

INDEX OF AUTHORS.

A reference in heavy type indicates that a paper by the author has been noticed.

- Abdussalam, M., **147**, 160.
 Abe, S., **124**.
 Abonnenc, E., **210**, 248.
 Adamson, A. M., **228**.
 Adhikari, A. K., **225**.
 Adler, S., **108**, **199**.
 Afanas'ev, S. F., **173**.
 Afridi, M. K., **7**, 153, 184, 210.
 Aitken, T. H. G., **259**.
 Alfeev, N. I., **241**.
 Ali (P. Mohamed), **9**.
 Aluimov, A. Ya., **240**.
 Alvarado, C. A., **12**, **247**.
 Amaral, A. D. F. do, **226**.
 Ambialet, R., **38**, **118**.
 Ambrosioni, P., **66**.
 Andrews, J., **30**.
 Antunes, P. C. A., **40**, 121.
 Aragão, H. de Beaurepaire, **94**.
 Artaud, P., **144**.
 Augustine, D. L., **105**.
 Austen, E. E., **159**, 164, 244.
 Ayroza Galvão, A. L., **13**, **226**,
 227, **228**.
 Aziz, M., **232**.
- Babenushev, V. P., **170**.
 Bacigalupo, J., **110**.
 Bailly, J., **149**, **194**.
 Baisas, F. E., **163**.
 Baker, F. C., **121**, **191**, **199**.
 Balzan, A., **175**.
 Banerjea, A. C., **6**.
 Banerji, S. K., **225**.
 Baran, M. Popescu-, **192**, **224**.
 Baranov, N., **15**, **85**, **168**.
 Barber, M. A., **182**.
 Bardelli, P., **14**.
 Barreto, M. Pereira, **226**, **227**.
 Bartels, E., **165**.
 Bartlett, K. A., **167**.
 Basso, P., **266**.
 Basso, R., **266**.
 Basu, B. C., **152**.
 Bates, M., **158**.
- Beaurepaire Aragão, H. de, **94**.
 Beccari, O., **175**.
 Bedford, H. W., **86**.
 Bekker, E., **224**, **248**.
 Bekker, P. M., **206**.
 Belcour, J. Colas-, **26**, **139**, **176**,
 238, **262**.
 Bellamy, R. E., **30**, **191**.
 Belschner, H. G., **61**.
 Benke, R., **57**.
 Bennett, B. L., **121**, **191**.
 Berberian, D. A., **133**, **200**.
 Berlese, A., **175**.
 Bero, D., **192**.
 Bertram, D. S., **144**.
 Beukering, J. A. van, **178**.
 Bevere, L., **116**, **162**, **213**.
 Bilal, Sait, **148**, **188**.
 Biryukov, V. I., **173**.
 Bishop, F. C., **29**.
 Blacklock, D. B., **14**.
 Blair, D. M., **200**.
 Bliss, C. I., **167**, **203**.
 Bock, E., **186**.
 Boldt, E., **124**.
 Boné, G., **111**, **141**.
 Bonne-Wepster, J., **187**, **234**.
 Borgstrom, F. A., **3**.
 Bovingdon, H. H. S., **252**.
 Boyd, M. F., **78**, **132**, **144**, **193**.
 Bradley, G. H., **167**.
 Braun, H., **148**.
 Brennan, J. M., **101**.
 Brett, G. A., **260**.
 Brink, C. J. H., **209**.
 Brody, A. L., **218**.
 Broom, J. C., **177**.
 Brown, A. A. Forbes, **41**.
 Brown, F. R., **128**.
 Bruce, W. G., **58**, **100**.
 Brug, S. L., **92**, **187**, **191**, **234**.
 Brumpt, E., **40**, **162**, **193**, **195**,
 238, **269**.
 Brumpt, L., **264**.
 Buck, A. de, **27**, **96**, **114**, **158**, **159**.
 Buduimko, F. A., **70**, **181**.

- Burdette, R. C., 25.
 Burr, M., 178.
 Bushland, R. C., 54, 259.
 Buxton, P. A., 109, 252.
- Callot, J., 151.
 Camargo, L. Patino, 139.
 Cambournac, F. J. C., 233.
 Cameron, D., 38.
 Cameron, G. R., 251.
 Cameron, J. W. M., 134.
 Cardoso, F. A., 42.
 Carnahan, C. T., 215.
 Carpano, M., 40.
 Carr, H. P., 30.
 Carson, G. B., 192.
 Caspari, E., 148.
 Castro Ferreira, L., 245.
 Causey, O. R., 107, 108, 178, 231.
 Cerqueira, N., 40, 224.
 Chadha, S. R., 244.
 Chagas, A. W., 245.
 Chagas, E., 66.
 Chandra, S. N., 153.
 Chatterjee, G. C., 9.
 Cheban, K. S., 76.
 Chédécal, M., 154, 224.
 Chodukin, N. I. (see Khodukin N. I.).
 Chopra, R. N., 152.
 Chorine, V., 262.
 Chorley, J. K., 20.
 Chowdhury, D. K. Das, 209.
 Chowdhury, K. L., 9.
 Christophers, Sir R., 183.
 Chung (Huei-lan), 131.
 Clarke, J. L., 29.
 Coggeshal, L. T., 231.
 Colas-Belcour, J., 26, 139, 176, 238, 262.
 Collignon, E., 33, 34, 118, 176, 233.
 Cooley, R. A., 63, 120, 160, 224.
 Cornejo, A., 266.
 Corradetti, A., 137, 175.
 Corrêa, R., 228.
 Corson, J. F., 18, 65, 142, 191, 266, 270.
 Cory, E. N., 215.
 Costa Lima, A. da, 13.
 Coste, E., 264.
 Cottam, C., 29.
 Covell, G., 207.
 Cox, H. R., 146.
 Cox, J. A., 64.
- Crabtree, H. S., 118.
 Crawford, M., 58.
 Crawford, R., 234.
 Crook, R. L., 234.
 Crosthwait, S. L., 215.
 Cunha, A. M. da, 157, 245.
 Curry, T. A., 7.
 Cushing, E. C., 103, 104.
 Cuthbertson, A., 249.
- da Costa Lima, A., 13.
 da Cunha, A. M., 157, 245.
 Daigh, F. C., 29.
 Dampf, A., 144.
 Danilova, M. I., 70, 181.
 Dao van Thai, 212.
 Das, B. K., 225.
 Das Chowdhury, D. K., 209.
 Dassanayake, W. L. P., 177.
 Davey, T. H., 130.
 Davies, W. M., 112.
 Davis, G. E., 146.
 Dayal, Srivastava Har, 96.
 Deane, L., 245.
 Deay, H. O., 128.
 de Beaurepaire Aragão, H., 94.
 de Buck, A., 27, 96, 114, 158, 159.
 de Jesus, P. I., 253.
 de la Paz, G. C., 164.
 Del Ponte, E., 2.
 Delpy, L., 150.
 Del Vecchio, G., 125, 175.
 de Magelhães, O., 35.
 De Meillon, B., 84, 192, 212, 226.
 de Mello, F., 9.
 de Moraes, R. Gomes, 244.
 Deonier, C. C., 102.
 Derbeneva-Ukhova, V. P., 69.
 der Eyden, T. J. van, 82.
 de Souza Lopes, H., 110.
 de Souza Pinto, G., 125.
 Devignat, R., 136.
 Dias, E., 35, 36, 94, 110, 144, 157, 192.
 Dinger, J. E., 248.
 Dinulesco, G., 198.
 Diong, Liem Soei, 66.
 do Amaral, A. D. F., 226.
 Dolmatova, A. V., 183.
 Doner, M. H., 56.
 Doniger, C. R., 251.
 Doss, M. A., 192.
 Dove, W. E., 101, 217.
 Dunn, L. H., 109.
 Duren, A., 136.

- Dushevskii, Ya. I., 220.
 Dyer, R. E., 146.
 Dzhangirov, K. G., 222.
- Eagleson, C., 56, 57, 105.
 Eckstein, F., 15, 49.
 Edwards, F. W., 160, 225, 243,
 244.
 Eichler, W., 96.
 Ejercito, A., 163, 253.
 Ekblom, T., 26.
 Emden, F. van, 225.
 Esaki, T., 256.
 Escamel, E., 25.
 Ethes, Y., 263.
 Evans, T., 46.
 Ewing, H. E., 5, 132.
 Exline, H., 224.
 Eyden, T. J. van der, 82.
- Face, L. La, 125.
 Fairer, C. D., 30.
 Fallis, A. M., 195.
 Farinaud, E. M., 225.
 Farinaud, M. E., 96, 127.
 Farr, M. M., 192.
 Faust, E. C., 30.
 Favot, M., 127.
 Fedina, O. A., 171.
 Ferreira, L. Castro, 245.
 Findlay, G. M., 151.
 Finlay, C. J., 144.
 Fisk, F. W., 259.
 Flanary, P. N., 30.
 Flegontova, A. A., 59.
 Flint, W. P., 262.
 Fotheringham, W., 89.
 Fox, W. F., 225.
 Franca, M., 121.
 Francis, E., 140.
 Fratani, L., 120.
 Frickhinger, H. W., 238.
 Fuller, M. E., 37.
- Gabaldon, A., 43, 248.
 Gahan, A. B., 169.
 Galliard, H., 28, 255.
 Galvão, A. L. Ayroza, 13, 226,
 227, 228.
 Garcia, E. Y., 253.
 Gasanov, A. P., 76.
 Gendel'man, Tz. A., 223.
 Gerasimova, A. A., 75.
- Gertler, S. I., 155.
 Ghidini, G. M., 142, 188.
 Ghosal, S. C., 168.
 Gibbins, E. G., 176, 225.
 Gibson, A., 29.
 Giglioli, G., 229.
 Gill, D. A., 197.
 Gillet, R., 118.
 Girard, R., 238.
 Gjullin, C. M., 231.
 Gladney, H., 105.
 Glass, J., 243.
 Gloyns, F. P., 251.
 Goidanich, A., 143.
 Gomes de Moraes, R., 244.
 Gopsill, W. L., 155.
 Gordon, R. M., 130.
 Goritzkaya, V. V., 72.
 Gösswald, K., 15.
 Gouget, R., 118.
 Gould, G. E., 128.
 Graham, N. P. H., 197.
 Graham-Smith, G. S., 160.
 Grandori, R., 84.
 Granett, P., 29.
 Gratch, I., 27.
 Green, R. G., 4.
 Gregson, J. D., 172.
 Griffin, F. C., 8.
 Guilhon, J., 178.
 Gunderson, H., 167.
 Gupta, S. C. Sen, 267.
 Gwatkin, R., 195.
- Hackett, L. W., 159, 182, 211.
 Haller, H. L., 24, 155.
 Hamilton, C. S. P., 206.
 Har Dayal, Srivastava, 96.
 Hardy, D. E., 31.
 Harendra Nath, Ray, 5.
 Harmston, F. C., 31.
 Hart, L., 63.
 Hartnack, H., 156.
 Hasell, P. G., 79.
 Hassal, A., 192.
 Hatch, M. H., 204, 224.
 Hawking, F., 267.
 Headlee, T. J., 29, 216.
 Hearle, E., 5.
 Heiberg, 168.
 Hell, J. C. van, 64.
 Henderson, G. T., 99.
 Henry, A., 178.
 Henry, C., 118.
 Henry, M., 249.

- Hérviaux, A., 212.
 Herman, C. M., 64.
 Herms, W. B., 189.
 Herr, A., 264.
 Hertig, M., 106.
 Hindmarsh, W. L., 61.
 Hinman, E. H., 30.
 Ho (Ch'i), 16, 63, 65, 130.
 Hoang-tich-Try, 256, 263.
 Hobson, R. P., 112.
 Hocking, K. S., 267.
 Hodgkin, E. P., 10, 92.
 Hoffmann, C. C., 80, 96, 122, 123.
 Holmes, W. E., 210.
 Hora, S. L., 8, 9.
 Horsfall, M. W., 58.
 Hoskins, W. M., 166.
 Hu, S. M. K., 82, 124, 179, 180.
 Hughes, A. W. McK., 62, 251.
 Hull, J. B., 166, 217.
 Hungerford, T. G., 63.
 Hunter, L., 113.
 Hurlbut, H. S., 40, 121.
 Hutton, E. L., 16.
- Inaba, S., 165.
 Ioff, I. G., 176.
 Itoh, H., 270.
 Ives, J. D., 151.
 Iyengar, M. O. T., 6, 8, 44, 160, 209.
- Jack, R. W., 20.
 Jackson, C. H. N., 19.
 Jackson, R. B., 158.
 Jacob, V. P., 208.
 Janjua, N. A., 135.
 Jao, S. G., 253.
 Jellison, W. L., 204, 248.
 Jerace, F., 142, 246.
 Jesus, P. I. de 253.
 Jobling, B., 54.
 Joga Rao, P. V., 225.
 Johannsen, O. A., 40.
 Johnson, C. G., 193.
 Jordan, C. F., 237.
 Jordan, K., 225.
 Jörg, M. E., 265, 266.
 Joyeux, C., 144.
- Kalandadze, L. P., 182, 183.
 Kalita, S. R., 75.
- Kamil, Server, 148.
 Kamito, N., 95.
 Kato, S., 154.
 Kéler, S., 120, 136.
 Kemper, H., 38, 143.
 Kentenich, A., 124.
 Kern, R. A., 248.
 Keshish'yan, M. N., 69, 183.
 Khodukin (Chodukin), N. I., 113.
 Kiker, C. C., 30.
 Kilgore, L. B., 250.
 King, W. V., 30, 53.
 Kingsbury, A. N., 10.
 Kirk, R., 129.
 Kirshenblat, Ya. D., 59.
 Kirshner, A., 89.
 Kitchen, S. F., 78, 132, 144, 193.
 Knowlton, G. F., 31.
 Kohls, G. M., 63, 120, 160.
 Kolpakova, S. A., 60.
 Komp, W. H. W., 140, 144.
 Kono, H., 143.
 Koo, C. K., 235.
 Krasikova, V. I., 223.
 Kröber, O., 192.
 Krontovskaya, M. K. Yatzimirs-kaya, 240.
 Kuipers, J., 126.
 Kumara Menon, M., 44.
 Kumm, H. W., 144.
 Kuwayama, S., 143, 154.
 Kuzina, O. S., 69.
- Laake, E. W., 192, 217, 269.
 Lacour, P., 113.
 La Face, L., 125.
 Lal, R. B., 168.
 Landauer, E., 91, 235.
 Lane, J., 13.
 Langeron, M., 78, 82.
 Larmuth, W. A., 48.
 Larson, C. L., 4.
 Lavergne, J., 91.
 Lavier, G., 224.
 Lawrence, T. C., 55.
 Lazarus, M., 64, 225.
 Lazuk, A. D., 180.
 Leeson, H. S., 191.
 Lefebvre, M., 64.
 Lennox, F. G., 112.
 le Roux, P. L., 94.
 Lester, H. M. O., 97, 266.
 Lever, R. J. A. W., 80, 155.
 Lewis, E. A., 89.
 Liem Soei Diong, 66.

- | | |
|------------------------------------|-----------------------------------|
| Lima, A. da Costa, 13. | Metcalf, C. L., 262. |
| Lin, P. C., 235. | Meyer, J. R., 41. |
| Linton, R. W., 169. | Michaelis, 171. |
| Lipman, J. G., 29. | Michelson, E. G., 81. |
| Lippert, N. P., 60. | Mihályi, F., 134. |
| Loghem, J. J. van, 176. | Mira, A. G., 96. |
| Lonzinger, G. K., 219. | Mira, M. G., 117. |
| Lopes, H. de Souza, 110. | Mironov, V. S., 69, 222, 224. |
| Lopez-Neyra, C. R., 96. | Mirzayan, A. A., 96. |
| Lorincz, F., 134. | Missiroli, A., 52. |
| Lowman, M. S., 64. | Mohamed Ali, P., 9. |
| Lubatti, O. F., 251. | Mohan, B. N., 247. |
| Lyle, C., 105. | Mohler, J. R., 145. |
| | Mondal, R. S., 225. |
| Macan, T. T., 191. | Moore, Walter, 242. |
| MacCallum, F. O., 151. | Moraes, R. Gomes de, 244. |
| MacCreary, D., 29, 194, 216. | Moreau, P., 138. |
| McCulloch, R. N., 205, 265. | Moreira, J. A., 35. |
| Macdonald, E. C., 160. | Morisita, T., 128. |
| Macdonald, G., 207. | Morris, M. L., 29. |
| Macfarlane, W. V., 135. | Mukherji, B., 168. |
| Macfie, J. W. S., 225. | Mulhern, T. D., 29. |
| McGovran, E. R., 24. | Mulligan, E. J., 88. |
| Mackay, R., 89. | Mulligan, H. W., 184. |
| Mackie, D. B., 106. | Münchberg, P., 27. |
| Mackie, F. P., 118. | Munro, J. W., 119. |
| MacLeod, J., 92, 190, 268. | Murray, C. A., 22. |
| MacNay, C. G., 14, 202. | Murray, D. R. P., 259. |
| Macy, R. W., 247. | Muschamp, P. A. H., 192. |
| Magalhães, O. de, 35. | Muylle, G., 246. |
| Mail, G. A., 172. | |
| Majid, S. A., 153. | |
| Mangabeira Filho, O., 144, 245. | Naik, R. N., 147. |
| Manson, D., 207. | Nainggolan, F. J., 144. |
| Marchoux, E., 262. | Nair, K. K., 8. |
| Markin, A. V., 75. | Nash, T. A. M., 19, 97, 201, 261. |
| Markovich, N. Ya, 183, 219. | Nath, Ray Harendra, 5. |
| Marneffe, H., 16. | Natvig, L. R., 198. |
| Martin, R., 34, 234. | Nelson, T. C., 29. |
| Martins, A. V., 35, 36, 157, 192. | Neri, F., 27. |
| Masillamani, S. G., 9. | Nétien, G., 232. |
| Mathew, M. I., 208. | Neyra, C. R. Lopez-, 96. |
| Mathis, M., 26, 176. | Nicolay, 37. |
| Matthews, C. B., 193. | Nicolle, P., 26. |
| Mayfield, R. B., 83. | |
| Mazumdar, P. C., 267. | |
| Mazza, S., 265, 266. | Obitz, K., 16. |
| Meillon, B. De, 84, 192, 212, 226. | Ohashi, S., 192. |
| Mellanby, K., 83, 191, 193. | Oldroyd, H., 243. |
| Mello, F. de, 9. | Olin, G., 95, 138. |
| Melvin, R., 54. | Olsuf'ev, N. G., 241. |
| Menon, M. A. U., 160. | Omori, N., 1, 2, 257. |
| Menon, M. Kumara, 44. | Ono, S., 21. |
| Mertens, W. K., 67. | Ono, Z., 108. |

- Oribe, H. Reyes, 266.
 Orlov, E. I., 219.
 Oswald, B., 149, 188, 194.
 Oudemans, A. C., 5.
- Page, A. B. P., 251.
 Parish, H. E., 103, 104.
 Parker, R. R., 146.
 Parrot, L., 16, 34, 234, 269.
 Patiño Camargo, L., 139.
 Patton, W. S., 16, 66, 192.
 Pavisić, V., 127.
 Pavlovskii, E. N., 239.
 Paz, G. C. de la, 164.
 Pearson, J. W., 128.
 Pemberton, C. E., 135.
 Pereira Barretto, 226, 227.
 Peters, G., 15.
 Peus, F., 169.
 Philip, C. B., 157, 205, 244.
 Phillips, G. L., 24.
 Phillips, J. H., 230.
 Pinto, G. de Souza, 125.
 Platt, N. G., 217.
 Plomley, N. J. B., 40.
 Pokrovskii, N. N., 222.
 Ponte, E. Del, 2.
 Popescu-Baran, M., 192, 224.
 Potapov, V. D., 170.
 Potter, C., 267.
 Poulton, W. F., 20.
 Powers, G. E., 216.
 Poynton, J. O., 92.
 Pratt, R. Y., 224.
 Prendel', A. R., 181.
 Pshenichnov, A. V., 241.
- Qadri, M. A. H., 14.
- Raabé, H., 186.
 Rafyi, A., 150.
 Rainey, R. C., 64.
 Ramachandra Rao, T., 44, 160, 208.
 Ramakrishna, V., 210.
 Ramijean, R., 127.
 Rao, A. M. Subba, 64.
 Rao, B. A., 7, 64.
 Rao, M. K. V. Venkat, 225.
 Rao, P. V. Joga, 225.
 Rao, T. Ramachandra, 44, 160, 208.
 Rao, V. Venkat, 210, 225.
- Ray, Harendra Nath, 5.
 Rebrin, M., 76.
 Rector, N. H., 30.
 Regendanz, P., 149.
 Reichenow, E., 149, 176.
 Reiley, F. A., 29.
 Remennikova, V. M., 74, 223.
 Remlinger, P., 194.
 Rendtorff, R. C., 105.
 Revich, E. I., 222.
 Reyes Oribe, H., 266.
 Ribeiro, D. J., 36.
 Riley, W. A., 40, 161.
 Roberts, F. H. S., 249.
 Robineau, 160.
 Robinson, G. G., 191.
 Robinson, W., 199.
 Rocha, F., 185.
 Rodhain, J., 246.
 Roe, R. J., 99.
 Roman, E., 232.
 Roncin, P., 212.
 Rondelli, M. Tonelli, 39, 175.
 Ross, Sir R., 82.
 Ross, G. A. P., 48.
 Roubaud, E., 139, 176, 213, 238, 262.
 Roudabush, R. L., 132.
 Roux, P. L. le, 94.
 Roy, D. N., 43, 109, 153.
 Ruibinskii, S., 127.
 Ruizhov, N. V., 240.
 Russell, Sir A. J. H., 191.
 Russell, P. F., 44, 152, 160, 208, 211, 247.
- Sagatelova, I. S., 182.
 Sait Bilal, 148, 188.
 Salem, H. H., 120.
 Sāmano, B., 122, 123.
 Sautet, J., 144.
 Savitzkii, V. I., 184.
 Scharff, J. W., 126, 211.
 Schierbeek, R., 63.
 Schmidt, G., 176.
 Schmidt, W. J., 248.
 Schoute, E., 158.
 Schüffner, W. A. P., 51.
 Schulze, P., 40, 248.
 Schwardt, H. H., 257.
 Schwetz, J., 144.
 Sellards, A. W., 121, 191.
 Sen, Purnendu, 8, 43, 109, 127, 160.

- Sen Gupta, S. C., 267.
 Senevet, G., 34, 120, 176, 210, 248, 263.
 Senior White, R., 8, 211, 225.
 Serdyukova, G. V., 239.
 Sergent, A., 38, 192.
 Sergent, Et., 120, 233, 248.
 Server Kamil, 148.
 Shannon, R. C., 106, 121, 193.
 Shapkin, L. A., 175.
 Sharif, M., 146.
 Shchurenkova, A. I., 183.
 Shields, S. E., 166.
 Shipitzina, N. K., 68.
 Shlenova, M. F., 73, 174.
 Shmeleva, Yu. D., 220.
 Shterngol'd (Sternhold), E. A., 11.
 Shubladze, A. K., 239.
 Shukhat, I. A., 222.
 Shute, P. G., 16, 116, 232.
 Sibiryakova, O. A., 67.
 Sicé, A., 263.
 Siddons, L. B., 153.
 Simanton, W. A., 23.
 Simmons, J. S., 30.
 Sinton, J. A., 6, 16, 115, 224, 232.
 Sioli, F., 124.
 Skey, C. R., 236.
 Skruinnik, A. N., 240.
 Smart, J., 243, 269.
 Smirnov, E. S., 174.
 Smith, C. L., 217.
 Smith, F. F. Strother-, 81.
 Smith, G. S. Graham-, 160.
 Sokolov, N. P., 77.
 Sollier, R., 154.
 Solodovnikova, O., 114.
 Somov, A. A., 181.
 Soni, B. N., 147, 244.
 Soper, F. L., 120.
 Southby, R., 98.
 Southwell, T., 89.
 Souza Lopes, H. de, 110.
 Souza Pinto, G. de, 125.
 Sparrow, H., 192.
 Spencer, G. J., 224.
 Spicer, W. J., 101.
 Srivastava, Har Dayal, 93.
 Stage, H. H., 231.
 Starzyk, J., 60.
 Stearns, L. A., 29.
 Stefanopoulo, G. J., 238.
 Stella, E., 39, 63, 176.
 Stender, M., 40.
 Stephanides, T., 14.
- Sternhold, E. A. (see Shterngol'd, E. A.).
 Stewart, J. L., 99.
 Stewart, M. A., 106, 258.
 Steyn, D. G., 206.
 Stone, A., 64.
 Stonis, J., 57.
 Strand, A. L., 167.
 Strickland, C., 9, 28, 248, 267.
 Strong, L. A., 156.
 Strother-Smith, F. F., 81.
 Subba Rao, A. M., 64.
 Sullivan, W. N., 24, 64.
 Sweet, W. C., 7, 64.
 Swellengrebel, N. H., 27, 51, 158, 159.
 Syddiq, M. M., 64, 123.
 Symes, C. B., 88, 98, 119.
- Tarwid, K., 186.
 Tattersfield, F., 269.
 Thai, Dao van, 212.
 Theodor, O., 5, 199.
 Thiel, P. H. van, 63, 162, 213.
 Thienemann, A., 128.
 Thompson, G. B., 40, 96, 269.
 Thomssen, E. G., 56.
 Tiflov, V. E., 170, 176.
 Timrot, S. D., 184.
 Tischler, N., 57.
 Tonelli Rondelli, M., 39, 175.
 Tonnoir, A. L., 37.
 Torrealba, J. F., 94.
 Torresi, F., 263.
 Toumanoff, C., 47, 91, 162, 213, 256, 263, 269.
 Trager, W., 16, 172, 199, 248.
 Travis, B. V., 102.
 Treillard, M., 91.
 Try, Hoang-tich, 256, 263.
 Turbett, C. R., 80.
 Twinn, C. R., 249.
- Ukhova, V. P. Derbeneva-, 69.
 Ungureanu, E., 116.
 Urbino, C. M., 164.
 Uroukoff, B., 150.
 Utенков, I. N., 180.
- Vainshtein, N. V., 221.
 Val'kh, S. B., 223.
 van Beukering, J. A., 178.
 van der Eyden, T. J., 82.

- | | | | |
|--|---|---|---|
| van Emden, F., 225.
van Hell, J. C., 64.
van Loghem, J. J., 176.
Vanni, V., 62, 165.
Vannote, R. L., 29.
van Thai, Dao, 212.
van Thiel, P. H., 50, 63, 162, 213.
van Volkenberg, H. L., 269.
Vargas, L., 123.
Vecchio, G. Del, 125, 175.
Venhuis, W. G., 64.
Venkat Rao, M. K. V., 225.
Venkat Rao, V., 210, 225.
Vinogradskaya, O. N., 184.
Vladimirova, M. S., 174.
Volkenberg, H. L. van, 269. | Wepster, J. Bonne-, 187, 234.
Werneck, F. L., 136.
Weyer, F., 77, 78, 139, 186.
Wheeler, C. M., 4, 131, 133.
White, R. Senior, 8, 211, 225.
Whitman, L., 121, 161.
Whittick, R. J., 96.
Wieting, J. O. G., 166.
Wigglesworth, V. B., 37, 169.
Williams, L. L., 29.
Wilson, D. B., 31.
Wilson, S. G., 260.
Wood, S. F., 132.
Woodbury, E. N., 17.
Woodhill, A. R., 37. | Yang, Y. N., 235.
Yates, W. W., 231.
Yatzimiriskaya - Krontovskaya,
M. K., 240.
Yokogawa, Sadamu, 177, 256. | Zikan, J. F., 218.
Zon, B. K., 159.
Zotta, G., 253.
Zottner, G., 264.
Zumpt, F., 120, 187, 188. |
|--|---|---|---|

GENERAL INDEX.

In the case of scientific names, the page reference is cited only under the heading of the generic name.

When a generic name is printed in brackets, it signifies that the name is not the one adopted.

A.

abortus, Brucella.

Acanthocheilonema perstans (see *Filaria*).

Acetic Acid, in mixture against lice on horses, 171.

Acidol, 68.

acinus, Ornithodoros delanoëi.

Aedes, in Bombay, 210; seldom parasitised by *Arrenurus* in Germany, 27; salinity tolerance of species of, in Japan, 165; breeding in pitcher-plant in Japanese Mandated Islands, 256; probably not transmitting encephalitis in Russian Far East, 70; in Sweden, 128; experimentally transmitting tularaemia, 241; repellents for, 29, 203.

Aedes aegypti, 48, 87; in W. Africa, 26, 47, 202; in Colombia, 189; in India, 263; in Indo-China, 28, 47, 213, 263, 269; in Japanese Mandated Islands, 256; in Kenya, 47, 88; in Sudan, 47; and yellow fever, 189; experiments with yellow fever vaccine virus and, 161; transmitting equine encephalomyelitis, 161; transmission of lymphocytic choriomeningitis by, 281; probably not transmitting Congo red fever, 202; experiments with filariae and, 28, 106, 179, 281; bionomics of, 26, 88, 214; experimental rearing and feeding of, 193, 213, 269; crossing experiments with *A. albopictus* and, 47, 263; eggs of, 96; action of oils on eggs of, 216; method of staining in larval stage, 80; anal papillae of larvae of, 37; tests of repellents against, 29.

Aedes albopictus, in Indo-China, 28, 47, 213, 263, 269; in Japanese Mandated Islands, 256; transmitting equine encephalomyelitis, 161; experiments with *Filaria* spp. and, 28; bionomics of,

214; experimental rearing of, 213, 269; crossing experiments with *A. aegypti* and, 47, 263; eggs of, 96.

Aedes aldrichi (see *A. lateralis*).

Aedes argenteus (see *A. aegypti*).

Aedes cantator, transmitting equine encephalomyelitis, 161.

Aedes caspius, in Algeria, 176,

Aedes cinereus, Bacterium tularensis in, in Sweden, 188; relation of, to *Filaria immitis* in U.S.A., 230.

Aedes communis, bionomics of, in Sweden, 128.

Aedes concolor, rectal papillae in larvae of, 38.

Aedes dorsalis, in U.S.A., 161, 232; transmitting equine encephalomyelitis, 161; factors affecting hatching of eggs of, 232.

Aedes durbanensis, experiments with Rift Valley fever and, in Kenya, 88.

Aedes echinus, breeding in tree-holes in Jugoslavia, 127.

Aedes excrucians, relation of, to *Filaria immitis* in U.S.A., 230.

Aedes fasciatus (see *A. aegypti*).

Aedes fluviatilis, in Colombia, 189; experimental vector of yellow fever, 189.

Aedes geniculatus, bionomics and distribution of, in Europe, 127, 189, 151; *Plasmodium gallinaceum* transmitted by, 176; experiments with yellow fever and, 139, 238; laboratory pairing and oviposition of, 262.

Aedes hirsuteron (see *A. sticticus*).

Aedes lateralis, in U.S.A., 156, 231; hatching and survival of eggs of, 156, 231.

Aedes leucocelaenus, in S. America, 121, 140; erroneously recorded in Panama, 140; natural occurrence of yellow fever in, 121; characters of, 140.

Aedes leucotaeniatus, sp. n., in Panama, 140.

- Aëdes lophoventralis*, early stages of, 160.
Aëdes mariae, breeding places of, in Corsica, 151; variations in, 151.
Aëdes nigromaculalis, in U.S.A., 161; transmitting equine encephalomyelitis, 161.
Aëdes ornatus (see *A. geniculatus*).
Aëdes pulchrithorax, sp. n., in Kenya, 160.
Aëdes punctor, bionomics of, in Sweden, 128.
Aëdes scapularis, in Brazil, 121, 193; in Colombia, 139; experimental vector of yellow fever, 139; experimental feeding of, 193.
Aëdes scutellaris, *Megarhinus* introduced into Fiji against, 80; breeding places of, 80.
Aëdes serratus, in Brazil, 193; experimental feeding of, 193.
Aëdes simpsoni, tests of gauze for screening against, in Sierra Leone, 181.
Aëdes sollicitans, transmitting equine encephalomyelitis, 161.
Aëdes sticticus, in Ontario, 203.
Aëdes stimulans, in Ontario, 203.
Aëdes taeniorhynchus, in Colombia, 139; carried to Florida in aeroplanes, 215; diseases experimentally transmitted by, 139, 161.
Aëdes terrens, in Brazil, 193; experimental feeding of, 193.
Aëdes togoi, bionomics of, in China, 158; experimentally infected with *Filaria bancrofti*, 158.
Aëdes trichurus, in Ontario, 203.
Aëdes triseriatus, relation of, to *Filaria immitis* in U.S.A., 230; experimental transmission of yellow fever by, 121, 191.
Aëdes vexans, in France, 15; in Ontario, 203; in U.S.A., 156, 161, 231; transmitting equine encephalomyelitis, 161; hatching and survival of eggs of, 156, 231.
Aëdes vexans var. *nipponii*, in Manchuria, 108.
Aëdes vittatus, tests of gauze for screening against, in Sierra Leone, 181.
aegypti, *Aëdes* (*Stegomyia*); *Anopheles*.
aegyptium, *Hyalomma*.
aeratum, *Hypoderma*.
Aeroplanes, carriage and control of mosquitos in, 31, 47-49, 87, 118-120, 215; risk of introduction of yellow fever into India by, 191; other insects carried in, 215; Paris Green applied from, against Anopheline larvae, 30.
aethiopicum, *Macroptilum*.
aethiopicus, *Phlebotomus schwetzi*. Africa, studies of Ceratopogonids and Muscids of, 84, 226; (West), keys to Anophelines of, 191. Africa, French West, mosquitos in, 26, 263; yellow fever in, 160; *Glossina* and sleeping sickness in, 263, 264.
Africa, Italian East, Anophelines and malaria in, 117, 187, 175, 176; *Phlebotomus* spp. in, 34, 234; sandfly fever possibly occurring in, 35; other blood-sucking Diptera in, 142, 188; lice and relapsing fever in, 129.
Africa, Portuguese East, Anophelines and malaria in, 212; *Glossina morsitans* in, 20.
Africa, South, Anophelines and malaria in, 212, 218; new Ceratopogonids in, 226; new fleas in, 192. (See Basutoland.) African Coast Fever, experiments with ticks and, in Kenya, 89.
africanus, *Linognathus* (see *L. stenopsis*).
Agamodistomum, parasitic in *Anopheles culicifacies* in India, 160.
agarici, *Megaselia* (*Aphiochaeta*).
aitkeni, *Anopheles*.
alaskaensis, *Theobaldia*.
Albania, Anophelines in, 158, 186; *Argas persicus* and spirochaetosis of poultry in, 40.
albimanus, *Anopheles*.
albinensis, *Orthopodomyia* (see *O. pulchripalpis*).
albipes, *Psorophora*.
albitarsis, *Anopheles*.
albopictus, *Aëdes* (*Stegomyia*).
alcedo, *Sarcophaga*.
Alcohol, reactions of *Musca domestica* to, 166.
aldrichi, *Aëdes* (see *A. lateralis*); *Cochliomyia*.
alfreddugèsi, *Trombicula* (*Microthrombidium*).
Algae, relation of mosquito larvae to, 18, 30, 43, 122, 159, 233, 247.
Algeria, Anophelines in, 33, 34, 69, 118, 120, 233, 248; other mosquitos in, 176, 213; malaria in, 34, 118; *Rhipicephalus sanguineus* and relapsing fever in, 36, 192.
algeriensis, *Anopheles*.

- Allantoin, preparations of, for treating wounds, 187.
- Alpha Naphthyl Isothiocyanate, 57.
(See Thiocyanates.)
- Amara*, host of fowl tapeworm in U.S.A., 146.
- amazonius*, *Culicoides*.
- Amblyomma*, new species of, in Br. Guiana, 175; of U.S.A., 160; transmitting anaplasmosis of cattle, 160.
- Amblyomma cayennense*, probable vector of Brazilian exanthematic typhus, 35, 36.
- Amblyomma brasiliense*, probable vector of Brazilian exanthematic typhus, 36.
- Amblyomma gemma*, not transmitting petechial fever in Kenya, 88.
- Amblyomma hebraeum*, in S. Rhodesia, 20.
- Amblyomma maculatum*, in U.S.A., 101, 145; probably not transmitting equine encephalomyelitis, 145; favouring infestation of animals by *Cochliomyia hominivora*, 101; dressings against, 101.
- Amblyomma philipi*, sp. n., in Mexico and Texas, 160.
- Amblyomma striatum*, Brazilian exanthematic typhus in, 36.
- Amblyomma variegatum*, on cattle in Guadeloupe, 85; not transmitting petechial fever in Kenya, 88.
- Amblyopinus henseli*, parasitising opossum in Brazil, 218.
- America, North, Tabaninae of, 64; identity of chigger mite in, 5.
- americana*, *Cochliomyia* (see *C. hominivora*); *Periplaneta*.
- Ammonia, production of, by blowfly larvae in wounds, 199; reaction of *Musca domestica* to, 166.
- Ammonium Carbonate, and indole, attractiveness of, for blowflies, 196.
- Ammonium Sulphate, tests with, as a mosquito larvicide, 209.
- Amphisylla*, revision of, 178.
- Anaemia of Horses, Infectious (see Swamp Fever).
- analis*, *Ophyra*.
- Anaplasma marginale*, in cattle in Kenya, 160; relation of ticks to, 160.
- Anaplasmosis, in domestic animals in India, 5; experiments with ticks and, in cattle in U.S.A., 145.
- anastassionis*, *Haemagogus*.
- anatolicum*, *Hyalomma*.
- andersoni*, *Dermacentor*.
- Aniseed, toxicity of oil of, to eggs of *Cochliomyia*, 259.
- Anisodactylus*, host of fowl tapeworm in U.S.A., 146.
- Anisolabis annulipes*, experiments with *Hymenolepis diminuta* and, in Argentina, 110.
- Anisotarsus*, host of fowl tapeworm in U.S.A., 146.
- anisus*, *Ceratophyllus (Monopsyllus)*.
- annularis*, *Anopheles*.
- annulata*, *Mansonia*.
- annulatus*, *Boophilus*.
- annulifera*, *Mansonia* (*Mansonioides*).
- annulipes*, *Anisolabis*.
- anomalus*, *Hoplopsyllus*.
- Anopheles*, of West Africa, 136, 191; production of breeding places for, by irrigation systems in India, 44, 152; larval characters of species of, in Netherlands Indies, 64; spraying against, in houses in Indo-China, 138; not recorded in Japanese Mandated Islands, 256; negative experiment with petechial fever and, in Kenya, 88; pupae of Malayan species of, 284; groups of, in Philippines, 163; drainage against, in millponds in Russia, 180; probably not transmitting encephalitis in Russian Far East, 70; classification of, in São Paulo, 226, 227; book on species of, that transmit malaria, 139; question of infection of, with *Plasmodium bubalis*, 40; experimentally transmitting tularaemia, 241; method of extracting glands and stomachs of, 64; significance of maxillary index of, 114; resting places of, 71, 73, 164, 253; range of flight of, 154, 210; tests of pyrethrum spray on, 119; natural enemies and diseases of, 8, 76, 175; flushing siphon for control of, in streams, 207; behaviour of larvae of, in oiled water, 221; method of preserving eggs of, 223, 248.
- Anopheles aegypti*, sp. n., in Sinai Peninsula, 120.
- Anopheles aitheni* var. *bengalensis*, in Philippines, 163; pupa of, 163.
- Anopheles albimanus*, bionomics and relation to malaria of, in Mexico, 80, 122, 123; in Venezuela, 48; in West Indies, 30, 34; eradication of, on Key West, 259; measures against, 80.

- Anopheles albimanus* var. *bisignatus*, n., in Mexico, 122.
Anopheles albimanus var. *trisignatus*, n., in Mexico, 122.
Anopheles albitarsis, in Brazil, 227, 228; probably not a vector of malaria in British Guiana, 229; in Venezuela, 48; not experimentally infected with malaria, 228; characters of, 227.
Anopheles algeriensis, in Italy, 125, 175; question of identity of eggs and supposed races of, 125, 175.
Anopheles annularis, 127; swarming and pairing of, in India, 160.
Anopheles apicimacula, in Venezuela 43.
Anopheles argyritarsis, not an important vector of malaria in Argentina, 12; in Brazil, 227, 228; erroneously recorded in British Guiana, 229; breeding places of, in Guadeloupe, 34; in Venezuela, 43; characters of, 227.
Anopheles atropos, in Florida, 215, 259; breeding places of, 259.
Anopheles bachmanni (see *A. triannulatus*).
Anopheles barberi, breeding in tree-holes in U.S.A., 128.
Anopheles barbirostris, in Hainan, 130; and malaria in Malaya, 10; relation of, to *Filaria* spp. in Travancore, 45.
Anopheles bifurcatus, auct. (see *A. claviger*).
Anopheles cinereus, in Italian E. Africa, 117, 137; breeding places of, 117.
Anopheles claviger, in Italy, 125; in Morocco, 78; in Poland, 186; in Portugal, 185; in Rumania, 253; in Russian Union, 71, 72, 73, 74, 76, 182, 183, 224; bionomics of, 74, 76, 78, 125, 182, 183.
Anopheles claviger var. *missiroli* n., in Italy, 175; eggs of, 175.
Anopheles claviger var. *petragnani*, n., in Italy, 175; eggs of, 175.
Anopheles costalis, auct. (see *A. gambiae*).
Anopheles coustani, in Italian E. Africa, 117, 137; in Egypt, 137; in Madagascar, 91; in houses in Tanganyika, 90; and malaria, 117, 137; breeding places of, 117.
Anopheles coustani var. *tenebrosus*, bionomics of, in S. Africa, 212, 213; and malaria, 213.
Anopheles coustani var. *ziemanni*, in French Sudan, 263.
Anopheles cristatus, characters of, in Philippines, 163.
Anopheles crucians, in U.S.A., 128, 191, 215; possible race of, 191; feeding on cows, 128; method of staining in larval stage, 79.
Anopheles culicifacies, in Ceylon, 207; in India, 6, 7, 44, 160, 207, 209; and malaria, 6, 7, 44, 209; food-preferences of, 44; breeding places of, 7, 44; Trematode parasite of, 160.
Anopheles cuyabensis (see *A. triannulatus*).
Anopheles darlingi, and malaria in Brazil and British Guiana, 227, 229, 230; bionomics of, 229, 230.
Anopheles darlingi var. *paulistensis*, bionomics of, in São Paulo, 227, 228; and malaria, 227, 228; eggs of, 227.
Anopheles davisii (see *A. triannulatus*).
Anopheles demeilloni, in Italian E. Africa, 117, 137; in Uganda, 226; breeding places of, 117.
Anopheles ditali, in Italian E. Africa, 176; in Algeria, 120.
Anopheles eiseni, and malaria in Mexico, 80, 81; in Venezuela, 43.
Anopheles elutus, see *A. maculipennis* (race *sacharovi*).
Anopheles fluviatilis, in Bahrain Islands, 153; in India, 7, 207, 208, 209, 225; and malaria, 7, 208, 209; breeding places of, 7.
Anopheles fuliginosus (see *A. annularis*).
Anopheles funestus, 225; in S. Africa, 218; in Belgian Congo, 137; in Madagascar, 91; in Sierra Leone, 65, 130; in French Sudan, 263; in Tanganyika, 32, 89, 90; and malaria, 89, 90, 137, 213; adult habits of, 213; fineness of screen cloth required against, 130; breeding places of, 32, 90; *Coccomyces* in, 65.
Anopheles funestus var. *imerinensis*, in Madagascar, 91.
Anopheles gambiae, in Portuguese E. Africa, 212; in S. Africa, 212, 213; in Brazil, 125, 126, 218; in Belgian Congo, 137; in Madagascar, 91; in Sierra Leone, 65, 130; in Anglo-Egyptian Sudan, 87; in French Sudan, 263; in Tanganyika, 32, 89, 90; in Uganda, 226; and malaria,

- 87, 89, 90, 125, 126, 137, 212, 213, 218; humidity affecting transmission of malaria by, 32; breeding places of, 32, 87, 90, 126, 212; other bionomics of, 126, 213, 218; *Coelomomyces* in, 65; fineness of screen cloth required against, 180; larval characters of, 219; used in tests of spraying aircraft, 49.
- Anopheles gambiae* var. *melas*, in houses in Tanganyika, 90.
- Anopheles garnhami*, in E. Africa, 32, 226.
- Anopheles gigas*, variety of, in Sumatra, 144.
- Anopheles gigas* var. *baileyi*, in China, 234.
- Anopheles gigas* var. *formosus*, in Philippines, 163; pupa of, 163.
- Anopheles hispaniola*, in Morocco, 78, 117; and malaria, 117; breeding places of, 78.
- Anopheles hyrcanus*, in Russian Union, 72, 113, 182, 223, 224; bionomics of, 72, 113.
- Anopheles hyrcanus* var. *lesteri*, eggs of, 47.
- Anopheles hyrcanus* var. *nigerrimus*, in Hainan, 180; in Travancore, 45; experiments with *Filaria* spp. and, 45; characters of, 180.
- Anopheles hyrcanus* var. *pseudopictus*, in Italy, 27, 116, 125; in Rumania, 253; in Russia, 71, 72; bionomics of, 71, 125, 253.
- Anopheles hyrcanus* var. *sinensis*, in China, 180, 234; in Indo-China, 47, 91, 154; in Manchuria, 108; and malaria, 91, 234; bionomics of, 91, 154; experimental rearing of, 47; characters of, 47, 180.
- Anopheles implexus*, in Uganda, 226.
- Anopheles inini*, sp. n., in French Guiana, 210, 211.
- Anopheles insulaeflorum*, in Philippines, 163; pupa of, 163.
- Anopheles jeyporiensis* var. *candidiensis*, in Hainan, 180.
- Anopheles kochi*, in Hainan, 180.
- Anopheles kolambaganensis*, in Philippines, 163; pupa of, 163.
- Anopheles lanei*, sp. n., habits of, in Brazil, 226.
- Anopheles leesoni* in Tanganyika, 32.
- Anopheles leucosphyrus*, in Philippines, 163; characters of, 160, 163.
- Anopheles leucosphyrus* var. *balaensis*, characters of, in Philippines, 163.
- Anopheles leucosphyrus* var. *riparis*, characters of, in Philippines, 163.
- Anopheles lindesayi*, in India, 69; in Tadzhikistan, 69, 183; breeding places of, 69; characters of stages and varieties of, 69, 163, 183.
- Anopheles lindesayi* var. *benguetensis*, 183; in Philippines, 163.
- Anopheles lindesayi* var. *cameronensis*, 69, 183.
- Anopheles lindesayi* var. *japonicus*, 183.
- Anopheles lindesayi* var. *nilgiricus*, 69, 183.
- Anopheles lindesayi* var. *pleccau*, 183; in China, 234.
- Anopheles longipalpis*, possible variety of, in Italian E. Africa, 137.
- Anopheles ludlowi*, auct. (see *A. sundasicus*).
- Anopheles maculatus*, breeding places of, in Malaya, 12, 46, 207, 210; and malaria, 12, 46, 210; range of flight of, 210.
- Anopheles maculatus* var. *hanabusai*, in Hainan and Formosa, 180; status of, 180.
- Anopheles maculipalpis*, in Madagascar, 91; difficulty of distinguishing *A. splendidus* and, 91.
- Anopheles maculipennis*, in Algeria, 33; in England, 116, 232; in Germany, 27, 49, 50, 124; in Greece, 14; in Holland, 27, 28, 50-52, 114, 162, 163; in Italy, 27, 52, 53, 116, 125, 162, 163, 186; in Mexico, 81; in Morocco, 117; in Poland, 186; in Portugal, 185, 233; in Rumania, 254, 255; in Russian Union, 67, 68, 71, 72, 78, 74, 75, 76, 113, 114, 127, 173, 174, 181, 182, 219, 220, 221, 223, 224; in Spain, 213; in Sweden, 26; in U.S.A., 259; and malaria, 26, 27, 28, 50, 51, 52, 53, 71, 72, 73, 74, 81, 91, 117, 125, 127, 181, 182, 185, 220, 223, 254, 255; experiments with malaria and, 115, 186, 232; use of, for inducing malaria, 124; *Plasmodium cynomolgi* not transmitted to man by, 16; *P. reichenowi* not developing in, 246; spirochaete in, 232; food-preferences of, 52, 63, 71, 78, 77, 114, 125, 162, 163, 181, 182, 213, 220; stimuli inducing feeding of, 63; apparatus for testing food-preferences of, 162; mouthparts

- of, 191 ; effect of temperature on blood-digestion and ovarian development in, 174 ; resting places of, 71, 73 ; hibernation of, 50, 68, 72, 73, 77, 91, 114, 181, 220, 223 ; winter mortality of unfertilised females of, 223 ; other bionomics of, 68, 71, 77, 78, 117, 220, 223 ; breeding places of, 33, 50, 52, 53, 71, 72, 75, 78, 81, 114, 125, 182, 221, 233, 254, 255 ; physico-chemical factors affecting larvae of, 33, 50, 52, 53, 75, 114, 125, 177, 254, 255 ; effect of crowding on larvae of, 51 ; mode of feeding of larvae of, 68, 224, 248 ; method of determining larval populations of, 233 ; natural enemies of, 27, 76 ; action of rotenone on larvae of, 232 ; eggs of, 116, 120 ; preservation of eggs of, 223 ; technique of rearing, 124 ; characters, bionomics and relation to malaria of races of, 27, 50, 51, 52, 53, 68, 71, 74, 75, 77, 78, 81, 113, 114, 116, 117, 125, 127, 159, 162, 163, 181, 182, 213, 248, 254, 255 ; experiments in crossing races of, 158 ; race *atroparvus*, 16, 26, 27, 50, 51, 52, 71, 72, 75, 77, 78, 91, 114, 115, 116, 127, 158, 162, 181, 182, 186, 213, 224, 232, 233, 254, 255 ; race *aztecus*, 81 ; race *labranchiae*, 26, 27, 52, 53, 116, 125, 158, 159, 162, 163, 186, 213 ; race *maculipennis* (*typicus*, *basilei*), 27, 52, 53, 72, 73, 75, 78, 116, 125, 127, 158, 181, 182, 186, 220, 224, 254, 255 ; race *melenoona*, 53, 125, 158, 159, 248 ; race *messeae*, 27, 50, 51, 52, 53, 67, 68, 71, 72, 74, 75, 77, 78, 114, 125, 127, 158, 159, 174, 181, 182, 186, 220, 221, 223, 224, 254, 255 ; race *sacharovi* (*elutus*), 14, 27, 52, 53, 76, 118, 114, 116, 117, 125, 158, 162, 163, 182, 255 ; race *subalpinus*, 158, 159, 182.
- Anopheles mangyanus*, and malaria in Philippines, 253.
- Anopheles marshalli* var. *gibbinsi*, in Uganda, 226.
- Anopheles marteri*, in Algeria, 33, 69 ; breeding places of, 33 ; larva of, 69 ; *A. sogdianus* compared with, 183.
- Anopheles mattogrossensis*, in Venezuela, 43.
- Anopheles mauritianus* (see *A. coustani*).
- Anopheles mediopunctatus*, in Venezuela, 43.
- Anopheles minimus*, in China, 130, 234, 235 ; in India, 207, 209, 225 ; in Indo-China, 162, 256 ; and malaria, 207, 209, 234, 235, 256 ; malaria parasites in, after feeding on animals, 162 ; breeding places of, 207.
- Anopheles minimus* var. *flavirostris*, and malaria in Philippines, 163, 164, 253 ; bionomics of, 253 ; measures against, 163, 164, 253.
- Anopheles moucheti*, and malaria in Belgian Congo, 137.
- Anopheles multicolor*, in Algerian Sahara, 118 ; in Egypt, 137, 207 ; doubtful relation of, to malaria, 137.
- Anopheles neivai*, bionomics of, in French Guiana, 211 ; characters of, 211.
- Anopheles neomaculipalpus*, in Venezuela, 43.
- Anopheles nigripes* (see *A. plumbeus*).
- Anopheles niti*, and malaria in Belgian Congo, 137 ; in Tanganyika, 32, 89.
- Anopheles novumbrosus*, and malaria in Malaya, 10.
- Anopheles oswaldoi*, in Brazil, 13, 227 ; in Fr. Guiana, 211 ; in Venezuela, 43 ; bionomics of, 227 ; characters and synonymy of, 211, 227 ; *A. tarsimaculatus* confused with, 13.
- Anopheles oswaldoi* var. *metcalfi*, n., in Brazil, 13.
- Anopheles oswaldoi* var. *noroestensis*, n., in Brazil, 13, 227 ; bionomics of, 227.
- Anopheles pallidus*, malaria in, in India, 209.
- Anopheles pattoni*, and malaria in China, 234, 235.
- Anopheles perezi* (see *A. triannulatus*).
- Anopheles pharoensis*, in Abyssinia, 117 ; in Belgian Congo, 137 ; in Egypt, 137 ; in Madagascar, 91 ; in Anglo-Egyptian Sudan, 87 ; in French Sudan, 263 ; in houses in Tanganyika, 32 ; and malaria, 117, 137 ; breeding places of, 87, 117.
- Anopheles philippensis*, in Hainan, 130 ; and malaria in India, 153, 209 ; in Indo-China, 127 ; doubtful value of fish against, 153.
- Anopheles plumbeus*, in Greece, 14 ; in Italy, 125 ; in Yugoslavia, 127 ; in Rumania, 253 ; in Russia, 78, 75, 182 ; possible relation of,

- to malaria, 182; breeding in tree-holes, 73, 75, 127, 253; bionomics of, 73.
- Anopheles pretoriensis*, in Abyssinia, 117, 137; in Tanganyika, 32; and malaria, 117; breeding places of, 117.
- Anopheles pseudopunctipennis*, in Argentina, 12, 13, 247; in Mexico, 81, 122, 123; in U.S.A., 259; in Venezuela, 43; bionomics and relation to malaria of, 12, 18, 81, 122, 123, 247; method of preventing breeding of, 247.
- Anopheles pulcherrimus*, in Central Asia, 113; in Bahrein Islands, 153; food-preferences of, 113.
- Anopheles punctimacula*, in Venezuela, 43.
- Anopheles punctipennis*, in Mexico, 81; in U.S.A., 128, 151, 230, 259; relation of, to *Filaria immitis*, 230; hibernating in caves, 151.
- Anopheles punctulatus*, and malaria in New Hebrides, 212; breeding places of, 212.
- Anopheles quadrimaculatus*, in U.S.A., 30, 128, 151, 215, 230, 257; relation of, to *Filaria immitis*, 230; experiments with *Plasmodium* spp. and, 79, 194; hibernating in caves, 151; method of staining in larval stage, 80.
- Anopheles rhodesiensis*, 176.
- Anopheles rhodesiensis* var. *dthalismilis*, n., in Italian E. Africa, 176.
- Anopheles rivulorum*, in Tanganyika, 32.
- Anopheles rondoni*, erroneous record of, in Mexico, 122.
- Anopheles rusipes*, and malaria in Belgian Congo, 187; in Madagascar, 91; in French Sudan, 263.
- Anopheles sacharovi*, see *A. maculipennis* (race *sacharovi*).
- Anopheles sancti-elii*, sp. n., in French Guiana, 210, 211.
- Anopheles sergenti*, in Algerian Sahara, 118; in Bahrein Islands, 153; and malaria in Egypt, 187; in Morocco, 78.
- Anopheles sintonoides*, sp. n., in Hainan, 63, 130; breeding in tree-holes, 63.
- Anopheles sogdianus*, sp. n., breeding places of, in Tadzhikistan, 183.
- Anopheles splendidus*, doubtful record of, in Madagascar, 91.
- Anopheles squamosus*, in Madagascar 91; in French Sudan, 263.
- Anopheles stephensi*, bionomics of, in Bahrein Islands, 153, 154; in India, 6, 153, 209; and malaria, 6, 153, 154; method of staining oöcysts in, 247; effect of drugs on infectivity of malaria for, 152; possible zoophilous race of, 153; tests of ammonium sulphate against, 209; eggs of, 64.
- Anopheles stephensi* var. *mysorensis*, eggs of, 64.
- Anopheles strobli*, in Brazil, 227, 228; in Fr. Guiana, 211; in Venezuela, 43; question of relation of, to malaria, 228; characters of, 211; types of eggs of, 227.
- Anopheles subpictus*, in India, 45, 208; in Netherlands Indies, 64; relation of, to *Filaria bancrofti*, 45; malaria in, 208; larval characters of, 64.
- Anopheles subpictus* var. *indefinitus*, in Hainan, 130.
- Anopheles sundaicus*, in India, 7, 8, 9, 43, 248; in Netherlands Indies, 64, 126, 159, 178; in Malaya, 10, 11; *Filaria* in, 178; and malaria, 7, 9, 10, 126, 248; breeding places of, 7, 9, 10, 11, 43; control of, in fish-ponds, 159; larval characters of, 64.
- Anopheles superpictus*, in Albania, 186; in Italy, 116; in Russian Union, 73, 74, 113, 114, 184; experiments with malaria and, 186; bionomics of, 113, 114, 184; laboratory rearing of, 184.
- Anopheles tarsimaculatus*, identity of Anophelines recorded as, in Brazil, 18; not an important vector of malaria in Br. Guiana, 229; in Fr. Guiana, 34, 210, 211; Anophelines of group of, in Fr. Guiana, 210, 211; in West Indies, 34, 311; in Venezuela, 43; characters and synonymy of, 34, 211.
- Anopheles tarsimaculatus* var. *aquacaelestis* (see *A. oswaldoi*).
- Anopheles tarsimaculatus* var. *aquasalis* (see *A. tarsimaculatus*).
- Anopheles transvaalensis*, auct. (see *A. demeilloni*).
- Anopheles triannulatus* (*bachmanni*), in Brazil, 227; in Fr. Guiana, 211; in Venezuela, 43; characters of, 211, 227; synonymy of, 227.
- Anopheles turkhudi*, in Sinai Peninsula, 120.

- Anopheles umbrosus*, and malaria in Malaya, 10.
- Anopheles vagus*, in houses in Hainan, 130; malaria in, in India, 208; bionomics of, in Indo-China, 91, 154; in Malaya, 12; tests of oils on larvae of, 12.
- Anopheles vagus* var. *limosus*, in Philippines, 163.
- Anopheles varuna*, in India, 43, 153, 207, 209, 225; and malaria, 153, 209; breeding places of, 43, 153; doubtful value of fish against, 153; larva of, 43.
- Anopheles walkeri*, in U.S.A., 30, 121, 128, 215; bionomics of, 30, 121, 128; larva of, 40.
- anserina*, *Spirochaeta (Treponema)*.
- Antelopes, experiments with *Trypanosoma rhodesiense* and, 19, 143, 267. (See Game.)
- antillensis*, *Pheidole fallax jelskii*.
- Ants, destroying *Cochliomyia hominivorax*, 156; destroying quail, 102; intermediate hosts of fowl tapeworms, 58, 190; importance of, in relation to health, 15; new *Phlebotomus* in nest of, 144.
- Apes, malaria parasites of, 193, 246.
- Aphanius dispar*, suggested use of, against Anopheline larvae in Bahrein Islands, 154.
- Aphiochaeta* (see *Megaselia*).
- apicimacula*, *Anopheles*.
- appendiculatus*, *Rhipicephalus*.
- aquacaelestis*, *Anopheles tarsimaculatus* (see *A. oswaldoi*).
- aquasalis*, *Anopheles tarsimaculatus* (see *A. tarsimaculatus*).
- arboris*, *Phlebotomus*.
- arcuata*, *Musca (Sarcopromusca)* (see *M. pruna*).
- Argas gurneyi* (see *Ornithodoros*).
- Argas persicus*, on fowls in Ceylon, 58; and spirochaetosis of poultry in India and Albania, 5, 40; experiment with louse-borne relapsing fever and, 130; coxal fluid of, 141.
- argenteus*, *Aëdes* (see *A. aegypti*).
- Argentina, insect hosts of *Hymenolepis diminuta* in, 110; mosquitoes in, 12, 140, 247; malaria in, 12, 247; flies causing myiasis in man and animals in, 2, 3, 265, 266; ticks of 94.
- argentina*, *Embia*.
- argentipes*, *Phlebotomus*.
- argyritarsis*, *Anopheles*.
- Armigeres obturbans*, *Filaria malayi* in, in Travancore, 45; experiments with *F. malayi* and, 45.
- Arrenurus*, parasitising mosquitos, 27.
- Arrenurus fimbriatus*, development of, 27.
- Arsenic, jetting with, against sheep blowflies, 136; reactions of *Musca domestica* to, 103.
- Arsenic Acid, reactions of *Musca domestica* to, 103.
- Arsenical Dips, types of, against parasites of sheep, 196; tests of toxicity of, to animals, 206.
- Arsmal, 68.
- Arthropods, catalogue of injurious, in Washington, 204.
- Arundo karka*, utilisation of, against Anopheline larvae, 9.
- Ashmeadopria*, parasite of *Musca domestica* in Porto Rico, 190.
- asini*, *Haematopinus*.
- asperus*, *Ornithodoros*.
- aspalatina*, *Jurečekia*.
- Asthma, due to sensitisation to *Megaselia agarici*, 248.
- astia*, *Xenopsylla*.
- Atebrin, effect of, on infection of Anophelines with *Plasmodium falciparum*, 115, 152.
- atriceps*, *Xanthochroa*.
- atroparus*, *Anopheles maculipennis*.
- atropos*, *Anopheles*.
- Atta texana*, new *Phlebotomus* in nest of, in U.S.A., 144.
- aureus*, *Staphylococcus*.
- austeni*, *Culicoides*.
- Australencyrtus giraulti* (see *Tachinaephagus zealandicus*).
- Australia, mosquitos in, 37, 38; blowflies infesting sheep in, 61, 112, 195-198, 265; parasite of blowflies in, 169; *Helicobia australis* in, 37; *Echidnophaga* of, 205, 249; fleas on domestic animals in, 205, 249; *Dermatophyllum gallinae* and spirochaetosis of poultry in, 63; ticks in, 249; list of insect parasites of birds and mammals of, 40.
- australiensis*, *Tachinaephagus* (see *T. zealandicus*).
- australis*, *Boophilus annulatus* (see *B. a. microplus*); *Helicobia*.
- autogenicus*, *Culex pipiens* (see *C. p. molestus*).
- autumnalis*, *Trombicula*.
- avus*, *Microlitchus*.
- Azolla*, protecting Anopheline larvae from fish, 153.
- aztecus*, *Anopheles maculipennis*.

B.

- Babesiella* (see *Piroplasma*).
babylonensis, *Spirochaeta*.
bachmanni, *Anopheles* (see *A. triannulatus*).
Bacillus pestis, development of, in fleas, 236; survival of, in flea faeces, 237. (See Plague.)
Bacillus typhosus, action of washings of maggots on, 195.
bacoti, *Liponyssus*.
Bacteria, relation of blowfly infestation of sheep to, 135; carriage of, by Muscoid flies, 164; action of washings of maggots on, 195.
Bacteriophage, in flies, etc., 192.
Bacterium tularensis, in *Aedes cinereus* in Sweden, 138; in *Dermacentor variabilis* in U.S.A., 237; *Hyalomma aegyptium* and tortoises infected with, 188. (See Tularaemia.)
Bahrain Islands, Anophelines and malaria in, 153.
baileyi, *Anopheles gigas*.
bailyi, *Phlebotomus*.
Baits, for flies, 69, 84, 103; reactions of *Musca domestica* to poisons in, 102, 103; ineffective against *Solenopsis*, 102.
balabacensis, *Anopheles leucosphyrus*.
bancrofti, *Filaria (Wuchereria)*.
barbata, *Sarcophaga*.
barberi, *Anopheles*.
barbirostris, *Anopheles*.
Barbus phutunio, doubtful value of, against Anopheline larvae in India, 153.
barraudi, *Phlebotomus*.
Basutoland, pests of sheep and goats in, 99.
batatas, *Trombidium*.
Batis maritima, preventing control of mosquito larvae by minnows in marshes, 217.
Bay Laurel, repellent to mosquitos, 203.
bequaerti, *Holoconops (Leptoconops)*.
Bed-bugs (see *Cimex hemiptera* and *C. lectularius*).
bengalensis, *Anopheles aitkeni*.
benguelensis, *Anopheles lindesayi*.
Benign Tertian Malaria (see *Plasmodium vivax*).
Benzol, in mixture against *Amblyomma* and *Cochliomyia*, 101.
berbericus, *Culex pipiens*.
bergeroti, *Phlebotomus papatasii*.
beziana, *Chrysomya*.
bifurcatus, auct., *Anopheles* (see *A. claviger*).
bigeminum, *Piroplasma*.
Birds, Arthropod parasites of, 38, 40, 93, 96, 178, 243; relation of house pests to nests of, 38; possible spread of rodent fleas and plague by flesh-eating, 204.
bisignatus, *Anopheles albimanus*.
bisnoven, *Simulium*.
bispinosa, *Haemaphysalis*.
bitaeniorhynchus, *Culex*.
Bitter Almond, toxicity of oil of, to eggs of *Cochliomyia*, 259.
Blatta orientalis, in houses in U.S.A., 128; not predacious on bed-bugs, 193; life-history and growth of, 14.
Blattella germanica, in houses in U.S.A., 55, 128; persistence of yellow fever virus in, 151; control of, by high temperature, 55; testing of fly-sprays on, 17, 18; technique of rearing, 17.
Blood, apparatus for feeding Diptera on, 56.
Blowflies, infesting sheep, 61, 62, 99, 105, 135, 136, 195-198, 249, 265; factors affecting infestation of sheep by, 112, 135, 196, 197; operation reducing susceptibility of sheep to, 62, 136, 197, 198; infesting other animals, 101, 105, 156, 249, 258; infesting fowls, 110; intestinal myiasis not produced by, 108; natural enemies of, 156, 169; factors affecting prevalence of, 104, 156; chemotropic reactions of, 166, 195; generative organs of, 160; effect of overcrowding on larvae of, 174, 175; chemical changes in larvae of, 64; prepupal diapause in, 83; baits and traps for, 103; measures against, 61, 62, 136, 196, 258, 265; technique of jetting against, 265; medium for testing larvicides against, 196; effect of calcium cyanamide on larvae of, 84; effect of volatile oils on eggs of, 259; use of, for treating wounds, etc., 187, 199; action of enzyme in, in wounds, 199; bactericidal properties of washings of larvae of, 195.
Bonin Islands, Oedemerid causing dermatitis in, 148.
Bont-legged Tick (see *Hyalomma impressum*).

- Boophilus annulatus*, campaign against on domestic animals in U.S.A., 145; on deer, 145; hereditary transmission of bovine anaplasmosis by, 160.
- Boophilus annulatus australis* (see *B. a. microplus*).
- Boophilus annulatus decoloratus*, relation of, to diseases of cattle in Kenya, 88, 160.
- Boophilus annulatus microplus* (on domestic animals), in Guadeloupe, 35; campaign against, in Porto Rico, 145.
- Borax, use of, in traps for blowflies, 196.
- Boric Acid, and glycerine, preparation of, against sheep blowflies, 62.
- Borneo, *Mansonia* spp. and *Filaria malayi* in, 187.
- Borrelia* (see *Spirochaeta*).
- Bovicola caprae*, on goats in Basutoland, 99.
- bovis*, *Hypoderma*; *Piroplasma (Babesielia)*.
- brasiliense*, *Amblyomma*.
- brasiliensis*, *Leishmania*; *Xenopsylla*.
- Brazil, Anophelines and malaria in, 18, 125, 126, 218, 226, 227, 228; other mosquitos in, 18, 40, 110, 121, 140, 193, 224; yellow fever in, 121, 193; Diptera carrying eggs of *Dermatobia hominis* in, 110; *Phlebotomus* spp. in, 66, 144, 245, 246; studies on visceral leishmaniasis of, 66, 157, 158, 200, 245, 246; Triatomids and *Trypanosoma cruzi* in, 94, 110; typhus of (see Brazilian Exanthematic Typhus); chigger mite infesting man in, 5; mange in animals in, 41; parasites of fowls in, 110, 244; Staphylinid parasite of opossum in, 218; collection of ticks from, 175.
- Brazilian Exanthematic Typhus, studies on hosts and vectors of, 35, 38, 157; possibly a form of Rocky Mountain spotted fever, 35, 36; summary of data on, 192.
- breviatus*, *Ctenophthalmus*.
- brevipalpis*, *Glossina*.
- Brilliant Green, method of staining mosquitos with, 90.
- British Isles, book on blood-sucking Diptera of, 243; mosquitos in, 54, 116, 191, 243; spirochaete in *Anopheles maculipennis* in, 232; *Cimex lectularius* in, 62, 251; *Hypoderma bovis* infesting man in, 269; blowflies infesting sheep in, 112; ticks and tick-borne diseases of domestic animals in, 92-94, 190, 242, 268; fleas on rats in, 83; lists of ectoparasites of mammals of, 269.
- Broquet's Medium, use of, for studying plague in fleas, 136.
- brucei*, *Trypanosoma*.
- Brucella abortus*, action of washings of maggots on, 195.
- bubalis*, *Plasmodium*.
- Buffalo, Anopheline attracted by, 253; identity of malaria parasites in Anopheline fed on, 40, 162.
- Bufo marinus*, in Fiji, 80, 155; not attacking mosquito larvae, 80; unlikely to destroy *Hister chinensis*, 155.
- Bulgaria, *Pediculoides ventricosus* causing dermatitis in, 150.
- Burma, ticks of, 248.
- bursa*, *Rhipicephalus*.
- Butyl Carbitol Thiocyanate, 18, 251. (See Thiocyanates.)
- Butyl Mesityl-oxide-oxalate, as a repellent against *Musca domestica*, 251.
- C.
- cadaverina*, *Cynomyia*.
- caesar*, *Lucilia*.
- caespitum*, *Tetramorium*.
- Cages, for rearing and studying flies, 56, 57.
- calcitrans*, *Stomoxys*.
- Calcium Arsenite, jetting with, against sheep blowflies, 136, 265; methods of using, 265.
- Calcium Cyanamide, experiments with, against flies, 143.
- Calcium Cyanide, effect of, on fleas in rodent burrows, 170.
- Calliphora*, effect of temperature on prevalence of, in U.S.A., 156; bactericidal properties of washings of larvae of, 195.
- Calliphora erythrocephala*, 195; in Hungary, 184; intestinal myiasis not caused by, 108; generative organs of, 160.
- Calliphora laemica*, infesting sheep in New Zealand, 135.
- Calliphora latifrons*, 195.
- Calliphora vomitoria*, infesting man in Argentina, 266.
- Calliphora vomitoria* var. *nigribarba*, 195.
- Camels, ticks transmitting tularaemia to, 241.

- cameronensis*, *Anopheles lindesayi*.
 Cameroons, British, *Cordylobia rod-haini* infesting man in, 144.
campester, *Phlebotomus bailyi*.
 Canada, mosquitos in, 29, 203; tick paralysis in man in, 172; insect parasites of deer in, 224; pests of domestic animals and poultry in, 5, 38; insect hosts of fluke of fowls in, 247; parasites and predators of Simuliids in, 249, 250.
 Canary, mite infesting, 178.
candidiensis, *Anopheles jeyporiensis*.
canicularis, *Fannia (Homalomyia)*.
Canis brasiliensis, Brazilian exanthematic typhus in, 36.
canis, *Ctenocephalides (Ctenocephalus)*.
cantator, *Aedes*.
Canthon pilularius (laevis), introduced into Porto Rico from U.S.A. against *Lyperosia*, 156, 167; parasite of, 167.
capitis, *Pediculus humanus*.
caprae, *Bovicola*; *Psoroptes*.
capricorni, *Haemagogus*.
 Caprylic Alcohol, unsuitable as repellent for mosquitos, 203.
caratea, *Spirochaeta (Treponema)*.
 Caraway Seed, toxicity of oil of, to eggs of *Cochliomyia*, 259.
 Carböl Fuchsin, method of staining mosquitos with, 90.
 Carbolic Acid, in repellent for mosquitos, 124.
 Carbon Dioxide, reactions of *Musca domestica* to, 166.
 Carbon Tetrachloride, fumigation with, against *Pediculoides ventricosus*, 151; value of pyrethrum extracts in, for spraying aircraft, 49, 119.
Cardamina flaccida, utilisation of, against *Anopheles pseudopunctipennis*, 18.
 Carrion's Disease (see Verruga).
 Cashew-nut Shell Oil, as a mosquito larvicide, 156.
caspius, *Aedes*.
 Cassia, toxicity of oil of, to eggs of *Cochliomyia*, 259.
 Castor Oil, in repellent for blood-sucking Diptera, 14, 203.
 Cattle, Anophelines feeding on, 44, 71, 78, 74, 77, 114, 123, 128, 153, 181, 182; malaria parasites in Anopheline fed on, 162; *Aedes togoi* feeding on, 158; doubtful effect of mosquitos on milk production in, 194; other blood-sucking Diptera attacking, 85, 154, 249; possible acquired immunity from *Danubiosimulium columbacense* in, 86; trypanosomiasis of, in Africa, 20, 260; blowflies infesting, 2, 249, 258; *Hypoderma* in, 16, 21, 99, 100, 145, 147, 165, 189, 198, 244; infestation of spinal canal of, by *H. bovis*, 192, 224; lice on, 94, 249; ticks and tick-borne diseases of, 5, 35, 39, 88, 89, 94, 145, 159, 160, 188, 219, 237, 240, 242, 243, 249, 269; experiments with Rift Valley and petechial fevers and, 88; toxicity of dipping fluids to, 206.
 Cats, fleas on, 109, 148; ticks on, 238, 242, 243; Brazilian visceral leishmaniasis in, 66; attempted production of intestinal myiasis in, 108.
caucasicus, *Phlebotomus*.
Cavia aperea, Brazilian exanthematic typhus in, 36.
cayennense, *Amblyomma*.
Ceratophyllum demersum, *Anopheles maculipennis* associated with, 75.
Ceratophyllum anisus (on rats), in China, 235; in Manchuria, 108.
Ceratophyllum fasciatum, on rats in England, 83; experiments with plague and, 237.
Ceratophyllum ilovaiskii, on *Citellus* in Russia, 60, 171.
Ceratophyllum montanus, on *Citellus beccheyi* in U.S.A., 106; fumigation experiments against, 106, 107.
Ceratophyllum nicanus, on rats in China, 235.
Ceratophyllum tesquorum (on *Citellus*), and plague in Manchuria, 109; in Russia, 60, 170; migrating from burrows of host, 170.
Ceratopogon, new subgenus and species of, in Zululand, 226.
Ceratopogonids, of Africa, 84, 226; British blood-sucking species of, 243, 244; classification and new species of, 84, 226, 243, 244.
cervicalis, *Onchocerca*.
cervicornutum, *Simulium*.
cesticillus, *Raillietina*.
 Cestodes, relations of insects to, 58, 110, 146, 189, 190; relation of mites to, 145.
 Ceylon, mosquitos in, 178, 207; filariasis in, 177, 178; *Phlebotomus* spp. in, 5, 6; *Argas persicus* on fowls in, 58.
 Chagas' Disease (see *Trypanosoma cruzi*).

- chagasi, Leishmania.*
Chagasia fajardoi, in Brazil, 227 ;
 early stages of, 227.
chandleri, Proteus.
cheopis, Xenopsylla.
 Chigger Mite, identity of N.
 American, 5.
 Chimpanzees, malaria parasites of,
 193, 246.
 China, mosquitos in, 63, 82, 124,
 130, 158, 179, 180, 234, 235, 255,
 256 ; malaria in, 130, 234 ;
Filaria bancrofti in, 82, 124, 179,
 180 ; *Phlebotomus* in, 82 ; rats,
 fleas and plague in, 91, 92, 235,
 236 ; lice and relapsing fever in,
 131 ; plant with insecticidal
 properties in, 61.
chinensis, Hister.
Chirostia crassiseta, predaceous on
 Simuliids in Jugoslavia, 16.
Chlaenius, host of fowl tapeworm in
 U.S.A., 146.
 Chloropicrin, toxicity of, to *Cimex*
lectularius, 167 ; effect of, on
 fleas in rodent burrows, 170.
Choanotaenia infundibulum (in
 fowls), insect host of, in U.S.A.,
 146.
cholerae, Vibrio.
Chrysomyia, in Philippines, 164.
Chrysomyia beziana, infesting man
 in Indo-China, 154.
Chrysomyia megacephala, numbers
 of eggs laid by, in India, 109.
Chrysomyia rufifacies, ovipositing
 on sheep in New Zealand, 135.
Chrysops discalis, doubtful relation
 of, to tularaemia in Sweden, 95.
ciliata, Psorophora.
 Cilional, effect of, on infection of
 Anophelines with malaria, 152.
Cimex, experiments with para-
 typhoid and, 148, 149.
Cimex hemiptera, in Japanese Man-
 dated Islands, 256 ; effects of
 low temperature on, 1.
Cimex lectularius, probably trans-
 mitting exanthematic typhus of
 Brazil, 35, 86 ; measures against,
 in Britain, 62, 251, 252 ; in
 Manchuria, 108 ; experiments
 with spirochaetes and, 140 ; ex-
 perimentally transmitting tular-
 aemia, 148, 241 ; bionomics of,
 2, 191 ; on dogs, 108 ; cock-
 roaches not predaceous on, 193 ;
 apparatus for using heat against,
 143 ; tests of toxicity of fumig-
 ants to, 167 ; method of rearing,
 105.
 Cimicids, key to N. American
 species of, 189.
cinerripennis, Eobia.
cinarella, Hylemyia (Paregle).
cinereus, Aedes ; *Anopheles*.
cinnabarina, Haemaphysalis.
cinnabaris, Trombicula (see *T.*
alfreddugèsi).
 Cinnamic Aldehyde, unsuitable as
 repellent for mosquitos, 203.
Citellus spp., in Manchuria, 109 ;
 in Russian Union, 59, 60, 170, 171,
 240 ; in U.S.A., 106, 204 ; fleas
 on, 59, 60, 106, 109, 170, 171 ;
 Staphylinid destroying fleas in
 burrows of, 59 ; effect of fumiga-
 tion on fleas of, 106, 107, 170 ;
 possible spread of fleas of, by
 birds, 204 ; tick on, 240 ; plague
 in, 204.
 Citral, unsuitable as a repellent
 against mosquitos, 203.
 Citronella Oil, as a repellent against
 mosquitos, 124, 203 ; formula
 containing, 124.
 Citronellol, as a repellent against
Musca domestica, 250.
claviger, Anopheles.
 Clove, repellent to mosquitos, 203 ;
 toxicity of oil of, to eggs of
Cochliomyia, 259.
Cnemidocoptes laevis, 178.
Cnemidocoptes mutans, infesting
 fowls in Brazil, 110.
Cochliomyia, in U.S.A., 103, 104,
 105 ; factors affecting abundance
 of, 104, 105, 156 ; experiment on
 trapping, 103.
Cochliomyia aldrichi, sp. n., 2.
Cochliomyia hominivorax (americana), in Argentina, 2, 3, 265, 266 ;
 in U.S.A., 54, 101, 102, 104, 156 ;
 infesting man, 3, 265, 266 ; infest-
 ing animals, 3, 101, 102, 156,
 192 ; acquired immunity from,
 in guineapigs, 3, 217 ; bacillus
 associated with, 3, 4 ; pH of
 wounds in relation to, 192 ;
Amblyomma maculatum favouring
 infestation by, 101 ; other blow-
 flies associated with, 101 ; effects
 of soil factors on, 54 ; ants
 destroying, 156 ; tests of food for
 adults of, 218 ; toxicity of
 volatile oils to eggs of, 259 ;
 dressing against, 101 ; survey of
 data on, 265 ; synonymy of, 2.
Cochliomyia laniaria, identity of, 2.
Cochliomyia lynchi (see *C. macel-
 laria*).

- Cochliomyia macellaria*, breeding habits of, in Argentina, 2, 3, 266; in U.S.A., 101, 104; occasionally infesting domestic animals, 2, 101; intestinal myiasis not caused by, 108; *C. hominivorax* confused with, 265; synonymy of, 2.
- Cockroaches, species of, in houses in U.S.A., 55, 128; not pre-dacious on bed-bugs, 193; possible relation of, to yellow fever, 151; control of, by high temperature, 55; testing of fly-sprays on, 17, 18; post-embryonic development of, 14; technique of rearing, 17.
- Coelomomyces*, in Anophelines in Sierra Leone, 65.
- Coelomomyces africanus*, sp. n., in Anophelines in Sierra Leone, 65.
- Coelomomyces anophelesica*, in Anophelines in India, 8.
- Coelomomyces indiana*, in Anophelines in India, 8.
- Colombia, mosquitos and yellow fever in, 139; other noxious Arthropods in, 139.
- Colorado Tick Fever, 189.
- Coloured Light, reactions of *Musca domestica* to, 134.
- columbacense*, *Danubiosimulum*.
- columbiae*, *Psorophora*.
- communis*, *Aedes*.
- concinna*, *Haemophysalis*.
- concolor*, *Aedes*.
- Congo, Belgian, Anophelines of, 186; other mosquitos in, 37, 202; malaria in, 187, 144; Ceratopogonids and their relation to disease in, 202; *Phlebotomus* spp. in, 16, 202, 269; Simuliids in, 202; fleas and plague in, 136.
- Congo Red Fever, question of vectors of, in Belgian Congo, 202.
- congolense*, *Trypanosoma*.
- congolensis*, *Phlebotomus*.
- Conjunctivitis, relation of Chloropids to, 189, 206.
- Copper Arsenite, Anopheline larvicide containing, 88.
- Copris incertus*, parasitised by *Sarcophaga alcedo*, 168.
- Copris incertus* var. *prociduus*, introduced into Porto Rico from Hawaii against *Lyperosia*, 190.
- Cordylobia rodhaini*, infesting man in Br. Cameroons, 144.
- coriaceus*, *Ornithodoros*.
- corporis*, *Pediculus* (see *P. humanus*).
- Corsica, *Aedes mariae* in, 151; *Gastrophilus haemorrhoidalis* infesting man in, 144.
- Costa Rica, new mosquito in, 144.
- costalis*, auct. *Anopheles* (see *A. gambiae*).
- Cottonseed Oil, in mixture against *Amblyomma maculatum*, 101.
- coustani*, *Anopheles*.
- crassipes*, *Mansonia*.
- crassiseta*, *Chirosia*.
- Creosote, in mixture against *Psoroptes caprae*, 147.
- Cresol, in mixture against *Haematomitus asini*, 171; unsuitable as repellent for mosquitos, 203.
- Crete, *Filaria bancrofti* in *Phlebotomus* in, 82, 83; behaviour in *Phlebotomus* of strain of *Leishmania tropica* from, 108.
- Cricetulus*, experiments with leishmaniasis and, 76.
- Cricetus cricetus*, experimentally infected with Brazilian visceral leishmaniasis, 158.
- cristatus*, *Anopheles*.
- crossi*, *Hypoderma*.
- cruciatus*, *Anopheles*.
- cruzi*, *Phlebotomus*; *Trypanosoma (Schizotrypanum)*.
- Ctenocephalides canis*, on rats in China, 235; plague in, in Belgian Congo, 136; in Manchuria, 109; in Queensland, 249; on cats in Turkey, 148; in U.S.A., 230; on dogs, 109, 230, 249; not infected with *Filaria immitis*, 230; experiment with tularaemia and, 148.
- Ctenocephalides felis*, Brazilian exanthematic typhus not found in, 35; on cats in Manchuria, 109; on dogs in Queensland, 249.
- Ctenocephalus* (see *Ctenocephalides*).
- Ctenophthalmus*, plague in, in Belgian Congo, 136; tularaemia in, on rodents in Russian Union, 241.
- Ctenophthalmus breviatus*, on *Citellus* in Russia, 60.
- Ctenophthalmus pollex*, on *Citellus* in Russia, 60, 170; seldom migrating from burrows of host, 170.
- Cuba, control of *Anopheles albimanus* in, 30.
- Culex*, in Guadeloupe, 34; of French Guiana, 248; negative experiment with petechial fever and, in Kenya, 88; of Philippines, 163; probably not transmitting encephalitis in Russian Far East, 70; hibernating in

- caves in U.S.A., 151 ; experiments with paratyphoid and, 148 ; new species of, 34, 163, 248.
- Culex bahamensis*, breeding places of, in Florida, 259.
- Culex bitaeniorhynchus*, development of malaria parasites in, 92.
- Culex fatigans*, in Australia, 37 ; in Ceylon, 178 ; distribution of, in China, 256 ; in Colombia, 139 ; in Belgian Congo, 37 ; carried to Florida in aeroplanes, 215 ; in Formosa, 124, 177 ; in India, 45, 46, 209 ; in Indo-China, 213, 269 ; in Japanese Mandated Islands, 256 ; in Malaya, 11, 92 ; vector of *Filaria bancrofti*, 11, 45, 46, 92, 177, 178, 256 ; experiments with *F. bancrofti* and, 45, 124 ; *F. bancrofti* not always associated with, 177, 256, 257 ; experimental vector of yellow fever, 139 ; breeding places of, 46, 256 ; effect of salinity and pH on larvae of, 37 ; life-cycle of, 214 ; experimental rearing of, 213, 269 ; method of staining, in larval stage, 80 ; tests of pyrethrum spray on, 119 ; tests of larvicides against, 53.
- Culex fuscans*, experiments with *Filaria bancrofti* and, in China, 82.
- Culex gelidus*, experiments with *Filaria bancrofti* and, in Travancore, 45.
- Culex pipiens*, 15 ; in Algeria, 213 ; in England, 54 ; in France, 113 ; in Manchuria, 108 ; winter breeding of, in swimming bath in Russia, 184 ; breeding places of, in U.S.A., 216 ; development of *Foleyella* spp. in, 179, 231 ; action of rotenone on larvae of, 232 ; status, biology and distribution of races of, 54, 113, 213 ; race *berbericus*, 213 ; race *molestus* (*autogenicus*), 54, 113 ; race *pipiens*, 54, 113.
- Culex pipiens* var. *pallens*, experiments with *Filaria bancrofti* and, in China, 124, 179, 180.
- Culex quinquefasciatus*, auct. (see *C. fatigans*).
- Culex territans*, relation of, to *Filaria immitis* in U.S.A., 106, 230.
- Culex theileri*, breeding places of, in China, 255.
- Culex tritaeniorhynchus* in Manchuria, 108.
- Culex vagans*, experiments with *Filaria bancrofti* and, in China, 124.
- Culex vishnui*, experiments with *Filaria bancrofti* and, in Travancore, 45.
- culicifacies*, *Anopheles*.
- culicis*, *Spirochaeta*.
- Culicoides*, of British Isles, 243, 244 ; in Japanese Mandated Islands, 256 ; in U.S.A., 166, 217 ; repellent for excluding, from houses, 166 ; control of, in salt marshes, 217 ; new species of, 244.
- Culicoides amazonius*, in Trinidad, 228.
- Culicoides austeni*, in Belgium Congo, 202 ; relation of, to diseases, 202.
- Culicoides debilipalpis*, in Trinidad, 229.
- Culicoides distinctipennis*, synonymy of, 84.
- Culicoides furens*, in Trinidad, 228.
- Culicoides grahami*, in Belgian Congo, 202 ; relation of, to diseases, 202.
- Culicoides guttatus*, in Trinidad, 228.
- Culicoides guttatus* var. *diabolicus*, in Trinidad, 228 ; possibly identical with *C. trinidadensis*, 229.
- Culicoides peliliouensis*, in Japanese Mandated Islands, 256.
- Culicoides pusillus*, in Trinidad, 229.
- Culicoides stellifer*, in Trinidad, 228.
- Culicoides trichopis*, possibly transmitting *Filaria perstans* in Belgian Congo, 202.
- Culicoides trinidadensis*, question of identity of, 229.
- Culicoides wansonii* (see *C. distinctipennis*).
- Cuprex, unsatisfactory against lice on horses, 171.
- cuprina*, *Lucilia*.
- cuyabensis*, *Anopheles* (see *A. triannulatus*).
- cyanescens*, *Psorophora*.
- cynomolgi*, *Plasmodium*.
- Cynomyia*, effect of temperature on prevalence of, in U.S.A., 156.
- Cynomyia cadaverina*, 195.
- Cynomys*, fleas on, in U.S.A., 248.
- Cyprus, Anophelines in, 232 ; *Hypoderma* in domestic animals in, 99, 100.

D.

damnosum, *Simulium*.

- Danubiosimulum columbacense*, bionomics of, in Jugoslavia, 15, 16, 85, 86; possible acquired immunity from bites of, 86; races and new form of, 85, 86.
darlingi, *Anopheles*.
Dasyprocta agouti, not experimentally infected with Brazilian visceral leishmaniasis, 158.
Dasyprocta azarae, Brazilian exanthematic typhus in, 36.
davisi, *Anopheles* (see *A. triannulatus*).
debegene, *Simulium*.
debilipalpis, *Culicoides*.
decoloratus, *Boophilus annulatus*.
Deer, insect parasites of, in British Columbia, 224; ticks on, 93, 94, 145, 143.
Deer Mice (see *Peromyscus*).
Deguelin, in *Tephrosia*, 208.
delanoëi, *Ornithodoros*.
demeilloni, *Anopheles*.
Dengue, Congo red fever possibly allied to, 202.
Denmark, *Hypoderma lineatum* in cattle in, 198, 199.
dentulosum, *Simulium*.
Dermacentor, nomenclature of species of, on sheep and goats in Italy, 39, 40; of U.S.A., 224; transmitting anaplasmosis of cattle, 160.
Dermacentor andersoni, 189; causing paralysis in man in Canada, 172; in U.S.A., 145, 146; experiments with bovine anaplasmosis and, 145; new infectious organism in, 146; guineapigs immunised against ticks by, 172.
Dermacentor marginatus, * bionomics and ecology of, in Russia, 241, 242.
Dermacentor marginatus lacteolus, 40.
Dermacentor nitens (see *Otocentor*).
Dermacentor nuttalli, transmitting tropical typhus in Russian Union, 240; hosts of, 240.
Dermacentor reticulatus, * 39, 40.
Dermacentor silvarum, bionomics and relation to encephalitis of, in Russian Union, 70, 219, 239, 240.
Dermacentor variabilis, hosts and relation to diseases of, in U.S.A., 145, 237; rodents immunised against ticks by, 172, 199; intracellular bodies in, 248.
Dermanyssus gallinae, transmitting spirochaetosis of poultry in Australia, 63.
Dermatitis, caused by *Euproctis flava*, 95; Oedemerids causing, 143, 256; caused by *Pediculoides ventricosus*, 66, 150.
Dermestes spp., hosts of *Hymenolepis diminuta* in Argentina, 110.
Derris, in washes against *Hypoderma*, 100, 145, 165; in dip against ticks, 243; action of, on mosquito larvae, 232.
diabolicus, *Culicoides guttatus*.
Diamanus (see *Ceratophyllus*).
Didelphys (see *Opossum*).
diminuta, *Hymenolepis*.
Dioclea longicornis, predacious on Simuliids in Jugoslavia, 16.
Dipping, against ticks, 94, 243; types of arsenicals for, against lice and *Melophagus* on sheep, 196; tests of toxicity to animals of fluids used for, 206.
Dirofilaria immitis (see *Filaria*).
discalis, *Chrysops*.
discolor, *Psorophora*.
distinctipennis, *Culicoides*.
Dodecyl Thiocyanate, 251. (See Thiocyanates.)
Dogs, Anophelines feeding on, 123; mosquitoes and *Filaria immitis* in, 11, 29, 105, 230; doubtful relation of other insects to *F. immitis* in, 230, 231; *Cimex lectularius* on, 108; fleas on, 109, 205, 230, 249; attempted production of intestinal myiasis in, 108; ticks on, 5, 35, 39, 237, 238, 241, 242, 243, 249; piroplasmosis of, 5; types of leishmaniasis in, 66, 76, 158, 245, 246; relation of, to typhus-group fevers, 35, 36, 238, 241.
domestica, *Musca*.
Donkeys, *Rhinoestrus purpureus* in, in India, 147; lice on, 186; Anophelines feeding on, 123.
donovani, *Leishmania*.
dorsalis, *Aedes*.
Drainage, methods of, against mosquito larvae, 8, 30, 46, 105, 217.
dromedarii, *Hyalomma*.
Drosophila fasciata, in Hungary, 134.
Drosophila funebris, in Hungary, 134.
Drosophila melanogaster, intestinal myiasis not caused by, 108.

* The names *marginatus* and *reticulatus* are used by different authors for the same species of *Dermacentor* [cf. R.A.E., B 23 139].—Ed.

drosophilae, *Spalangia*.
dthali, *Anopheles*.
dthalisimilis, *Anopheles rhodesiensis*.
dubius, *Pachycrepoides*.
Ducks, probable value of, against
Anopheline larvae, 175; dragon-
fly hosts of fluke of, 247.
Dung, relation of *Musca* spp. to
types of, 69, 164.
duodecimum, *Simulium*.
Duranta plumieri, action of, as a
mosquito larvicide, 207, 208.
durbanensis, *Aëdes*.
duttoni, *Spirochaeta* (*Borrelia*).

E.

Echidnophaga, key to Australian
species of, 205.
Echidnophaga gallinacea, hosts and
distribution of, in Australia, 205,
249.
Echidnophaga myrmecobii, hosts of,
in Australia, 205, 249.
Echidnophaga perilis, hosts and
distribution of, in Australia, 205.
echinobothrida, *Raillietina*.
Echinochloa, *Anopheles* associated
with, in Sudan, 87.
Echinolaelaps echidninus, experi-
ments with leprosy and, 262.
echinus, *Aëdes*.
Eciton, destroying *Cochliomyia*
hominivorax in U.S.A., 156.
Economic Entomology, text-book
on, 262.
Egypt, mosquitos in, 120, 137, 207;
malaria in, 187.
Eichhornia, *Culex theileri* associated
with, 256.
Eichhornia crassipes, relation of
Mansonia spp. to, 11, 187, 255.
eiseni, *Anopheles*.
elongatus, *Platyprosopus*.
elutus, *Anopheles* (see *A. macul-
pennis* race *sacharovi*).
Embria argentina, experimental host
of *Hymenolepis diminuta* in
Argentina, 110.
Encephalitis (in man), relation of
ticks to, in Russian Union, 69, 70,
239, 240; caused by equine
virus in U.S.A., 161.
Encephalomyelitis, Equine, prob-
lem of vectors of, in horses in
U.S.A., 31, 145, 146, 161; ex-
perimental transmission of, by
mosquitos, 31, 161, 189; multi-
plication of virus of, in mosquito
tissues, 16; disease in man
caused by, 161.

Encephalomyelitis, Ovine (see
Louping-ill).
Enteromorpha, *Anopheles sundaicus*
associated with, 43.
Eobia cinereipennis ogasawarensis,
skin lesions caused by, in Japanese
Pacific Islands, 143, 256.
Eosine, method of staining oöcysts
in mosquitos with, 247.
equi, *Haematopinus* (see *H. asini*).
erraticus, *Ornithodoros*.
erythrocephala, *Calliphora*.
Ethyl Alcohol, reactions of *Musca*
domestica to, 166.
Ethylene Oxide, toxicity of, to
Cimex lectularius, 167.
Eukraiohelea (see *Stilobezzia*).
Eumusca, considered a distinct
genus, 65. (See *Musca*.)
Euproctis flava, dermatitis caused
by, in Korea, 95.
Eutriatoma maculata, distribution
of, in S. America, 94; *Trypano-
soma cruzi* in, 94.
Eutriatoma sordida, experiment
with *Trypanosoma cruzi* and,
110.
Eutriatoma uhleri, in U.S.A., 157;
experiments with Rocky Moun-
tain spotted fever and, 157.
evertsi, *Rhipicephalus*.
excrucians, *Aëdes*.
eximia, *Lucilia*.
expansa, *Moniezia*.

F.

fajardoi, *Chagasia*.
falciparum, *Plasmodium*.
fallax, *Pheidole*.
Fannia, habits of, in S. Rhodesia,
249.
Fannia canicularis, in Hungary,
134; breeding habits of, in
Jugoslavia, 168.
Fannia fusconotata, probably infest-
ing man in Argentina, 266.
Fannia heydeni, probably carrying
eggs of *Dermatobia hominis* in
Brazil, 110.
Fannia petrocchiae, carrying eggs of
Dermatobia hominis in Brazil,
110.
Fannia scalaris, habits of, in
Hungary and Jugoslavia, 184,
188.
fasciata, *Drosophila*.
fasciatus, *Aëdes* (*Stegomyia*) (see
A. aegypti); *Ceratophyllus*
(*Nosopsyllus*).
fatigans, *Culex*.

- felis*, *Ctenocephalides* (*Ctenocephalus*).
 Fennel Seed, toxicity of oil of, to eggs of *Cochliomyia*, 259.
ferox, *Psorophora*.
Ficus benjamina, use of, for shading against Anopheline larvae, 30.
 Fiji, Histerid introduced into, against house-flies, 155; mosquitos and their biological control in, 80.
Filaria, in *Anopheles sundaeicus* in Netherlands Indies, 178.
Filaria bancrofti, in Ceylon, 178; in China, 82, 124, 179, 180; in Crete, 83; in Formosa, 124, 177; in Indo-China, 28; in Loochoo Is., 257; in Malaya, 11, 92; mosquitos naturally infected with, in Travancore, 45, 46; transmitted by *Culex fatigans*, 11, 45, 46, 92, 177, 178, 256; experiments with mosquitos and, 28, 45, 82, 124, 158, 179, 180; factors affecting transmission of, by mosquitos, 177, 179; possibility of transmission of, in other ways, 177, 257; in *Phlebotomus*, 82, 83; experiment with *Pulex irritans* and, 257.
Filaria immitis (in dogs), experiments with mosquitos and, in Malaya, 11, 12; and mosquitos in U.S.A., 29, 105, 230; doubtful relation of other insects to, 230, 231.
Filaria malayi, in Borneo, 187; in Ceylon, 178; in Indo-China, 28; in Malaya, 11, 92; in Travancore, 45, 46; and *Mansonia* spp., 11, 45, 46, 92, 178, 187; in other mosquitos, 45; experiments with mosquitos and, 11, 28, 45.
Filaria perstans, relation of *Culexoides* to, in Belgian Congo, 202.
 Filariasis, in Ceylon, 177, 178; epidemiology of, in Travancore, 44-46; in Netherlands Indies 178. (See *Filaria* spp. and (in frogs) *Foleyella*.)
fimbriatus, *Arrenurus*.
Finlaya (see *Aedes*).
 Fish, against mosquito larvae, 8, 9, 30, 76, 77, 87, 90, 125, 153, 154, 185, 211, 212, 217, 233; destroying Simuliid larvae, 250; not affected by Paris Green, 159.
 Fish-ponds, control of Anopheline larvae in, 159.
flava, *Euprostis*.
flavirostris, *Anopheles minimus*.
 Fleas, of birds in Germany, 96; of Palaearctic Region, 63; monograph on important species of, 169; as hosts of cestodes, 189; *Filaria* spp. not developing in, 230, 257; and plague, 10, 59, 60, 92, 106, 109, 136, 189, 204, 235, 236, 237; persistence of plague in, 59, 60, 106, 109, 237; experiments with plague and, 236, 237; medium for studying plague in, 136; and tularaemia, 148, 241; and endemic typhus, 189; Brazilian exanthematic typhus not found in, 35; on cats, 109, 148; on dogs, 109, 205, 230, 249; on rats, 10, 83, 87, 91, 92, 96, 108, 133, 235, 236, 237; on other rodents, 59, 60, 106, 109, 170, 171, 189, 204, 205, 236, 237, 241, 248; (of rodents), question of transport of, by birds, 204, 205; persistence of, in empty burrows, 60; migration of, from burrows, 170; beetles destroying, 59, 171; effects of temperature and humidity on, 109, 235, 236; effect of fumigation on, 106, 107, 170, 189; classification and new species of, 176, 192, 205, 248.
 Flushing Siphon, for controlling Anopheline larvae in streams, 207.
fluviatilis, *Aedes*; *Anopheles*.
 Fly-sprays, against mosquitos, 31, 48, 49, 51, 90, 119, 138, 215; types of, and methods of using, for spraying aircraft, 31, 48, 49, 119, 215; technique and results of tests of, on flies, 17, 18, 22-24, 57, 105, 203, 267; technique of tests of, on cockroaches, 17, 18; effect of fineness of atomisation of, on toxicity to insects, 25; dyes for ascertaining concentration of, in air, 268; constituents for, 18, 24, 31, 49, 51, 57, 90, 119, 138, 155, 215, 268; preparation of, from pyrethrum, 155; methods of determining pyrethrins in, 64.
Foleyella (in frogs), development of, in mosquitos, 178, 231.
Foleyella ranae, 231.
forceps, *Psorophora*.
 Formosa, form of *Anopheles maculatus* in, 130; *Culex fatigans* and *Filaria bancrofti* in, 124, 177.
formosus, *Anopheles gigas*.
 Fowl-pox, relation of mosquitos to, 189.

- Fowls, Anophelines feeding on, 71, 77; relation of blood-sucking Diptera to diseases of, 127, 189; *Lucilia eximia* infesting, 110; Cimicid associated with, 244; *Echidnophaga gallinacea* on, 205; lice on, 39; *Argas persicus* on, 5, 40, 58; mites infesting, 38, 63, 110, 160; spirochaetosis of, 5, 40, 63; insect hosts of parasitic worms of, 58, 146, 190, 247; survey of parasites of, in Canada, 5; destroying fly larvae in dung, 168.
- France, *Hypoderma bovis* in horses in, 238; mosquitos in, 15, 113, 139, 151; Tabanids in, 192; mite infesting man in, 5.
- Frogs, Anophelines feeding on, 114; mosquitos and *Foleyella* spp. in, 178, 231.
- Frontopsylla semura*, on *Citellus* in Russia, 60, 170; migrating from burrows of host, 170.
- fuliginosa*, *Periplaneta*.
- fuliginosus*, *Anopheles* (see *A. annularis*).
- fulvoventralis*, *Stenoterys* (see *Tachinaeaphagus zealandicus*).
- funebris*, *Drosophila*.
- funestus*, *Anopheles*.
- Fungi, infesting mosquitos, 8, 65, 96; possibly parasitising Simuliid pupae, 250.
- funicola*, *Siphunculina*.
- furens*, *Culicoides*.
- fuscanus*, *Culex*.
- fusconotata*, *Fannia*.
- G.**
- gallinacea*, *Echidnophaga*.
- gallinaceum*, *Plasmodium*.
- gallinaceae*, *Dermanyssus*.
- Gallos bankiva murghi*, new mite on, in India, 160.
- Galumna*, relation of sheep tape-worm to, in U.S.A., 145.
- gambiae*, *Anopheles*.
- gambiense*, *Trypanosoma*.
- Gambusia*, utilisation of, against mosquito larvae, 30, 87, 125, 185, 233; cage for preventing cannibalism among, 233; other fish compared with, 8, 77.
- Game, relation of *Glossina* to, 20, 188; doubtful relation of sleeping sickness to, 200, 201. (See Antelopes.)
- Gardenia campanulata*, action of, as a mosquito larvicide, 208.
- garnhami*, *Anopheles*.
- Gastrophilus haemorrhoidalis*, infesting man in Corsica, 144.
- Geese, *Argas persicus* and spirochaetosis of, 40.
- gelidus*, *Culex*.
- geminata*, *Solenopsis*.
- gemma*, *Amblyomma*.
- geniculatus*, *Aedes*.
- Geranium Essences, repellent to mosquitos, 203.
- germanica*, *Blattella*.
- Germany, *Anopheles maculipennis* in, 27, 49, 50, 77, 78, 124, 158; malaria in, 50; other mosquitos in, 27, 54; mites parasitic on mosquitos in, 27; fleas in, 96, 169; parasites of domestic animals in, 40, 165, 171; book on pest control in, 238; *Sphaeridium scarabaeoides* introduced into Hawaii from, 135.
- Gerris najas*, predacious on Simuliids in Yugoslavia, 16.
- gibbinsi*, *Anopheles marshalli*.
- Giemska's Stain, mosquito larvae treated with, 80.
- gigas*, *Anopheles*; *Phlebotomus*.
- giraulti*, *Australencyrtus* (see *Tachinaeaphagus zealandicus*).
- Glossina*, in E. Africa, 89, 266; in Nigeria, 97, 286; and sleeping sickness, 97, 264, 266; possibly producing immunity from *Trypanosoma rhodesiense* in man, 201; relation of, to game, 20, 188; effect of forest density on, 97, 98; clearing against, 20, 41, 42, 88, 97, 98, 99, 201; review of measures against, 224.
- Glossina brevipalpis*, in Kenya, 98, 99; bionomics and ecology of, in Nyasaland, 261.
- Glossina longipennis*, in Abyssinia, 188.
- Glossina morsitans*, in Portuguese E. Africa, 20; in S. Rhodesia, 20, 200, 201; in Anglo-Egyptian Sudan, 87; in Fr. Sudan, 264; bionomics and ecology of, in Tanganyika, 19, 188; in Uganda, 20; and sleeping sickness, 188, 200, 201; and trypanosomiasis of animals, 188; experiments with *Trypanosoma* spp. and, 19, 65, 143, 176, 191, 267; game destruction and clearing against, 20; rearing and maintenance of, 177; comparison of East and West African races of, 19, 97, 201.

- Glossina morsitans submorsitans*, bionomics and ecology of, in Nigeria, 19, 97, 98, 201, 261, 262; in Fr. Sudan, 264.
- Glossina pallidipes*, in Kenya, 89, 98, 99; and trypanosomiasis of animals in Tanganyika, 188; ecology of, 188.
- Glossina palpalis*, in Gold Coast, 99; in Kenya, 88, 98; in Nigeria, 97, 98; in Sudan, 264; in Tanganyika, 188; transmitting sleeping sickness in Uganda, 41; trypanosomes in, 41; bionomics and ecology of, 41, 97, 98, 188; clearing against, 41, 42, 88, 98, 99; value of hand collection against, 98, 99.
- Glossina swynnertoni*, and trypanosomiasis of man and animals in Tanganyika, 188; ecology of, 188.
- Glossina tachinoides*, clearing against, in Gold Coast, 99; in Nigeria, 97, 201, 261; in Fr. Sudan, 264; bionomics and ecology of, 97, 201, 261, 262, 264.
- Glugea varians* (see *Thelohania*).
- Glycerine, and boric acid, preparation of, against sheep blowflies, 62.
- Gnathoncus rotundatus* var. *suturifer*, destroying fleas in rodent burrows in Russia, 171.
- Goats, blowflies infesting, 105; *Hypoderma* spp. in, 100, 244; lice on, 99, 188; ear mange in, 147; ticks on, 39, 40, 145, 237; tick-borne diseases of, 5.
- Gobius criniger*, destroying mosquito larvae in Tanganyika, 90.
- Goeldia*, associated with yellow fever in Brazil, 121, 198; experimental feeding of, 193.
- Gold Coast, *Aedes aegypti* in, 47; *Glossina* spp. in, 99.
- Gomphus spicatus*, intermediate host of *Prosthogonimus* in N. America, 247.
- Gorilla, malaria parasites of, 193.
- grahami*, *Culicoides*.
- Grasshoppers, Sarcophagid associated with, in Australia, 37.
- Greece, mosquitos in, 14, 54.
- griseicollis*, *Simulium*.
- groenlandica*, *Phormia* (see *P. terraenovae*).
- Grouse, *Ixodes ricinus* on, in Britain, 94, 248.
- Guadeloupe, mosquitos in, 34, 211; ticks in, 35.
- Guiana, British, Anophelines and malaria in, 229, 230; *Aedes leucocelaenus* in, 140; *Eutriatoma maculata* in, 94; ticks in, 175.
- Guiana, Dutch, new *Trombicula* in, 63.
- Guiana, French, Anophelines in, 34, 210; *Culex* of, 248.
- Guineapigs, rickettsiae in lice of, 26; development of immunity from Arthropod parasites in, 3, 172, 199, 217.
- gurneyi*, *Ornithodoros (Argas)*.
- guttatus*, *Culicoides*.
- Gyrinus natator*, predacious on Simuliids in Jugoslavia, 16.
- H.
- Haemagogus*, in Brazil, 193; experimental feeding of, 193.
- Haemagogus anastasianis*, larva of, 144.
- Haemagogus capricorni (janthinosys)*, natural occurrence of yellow fever in, in Brazil, 121; synonymy of, 121.
- Haemagogus mesodentatus*, sp. n., in Costa Rica, 144.
- Haemagogus tropicalis*, sp. n., in Brazil, 40.
- Haemaphysalis*, possible vector of Brazilian exanthematic typhus, 36.
- Haemaphysalis bispinosa*, on domestic animals in Queensland, 249; not transmitting bovine piroplasmosis, 249.
- Haemaphysalis cinnabarinus punctata*, and piroplasmosis of cattle in Britain, 268; on sheep in Italy, 39.
- Haemaphysalis concinna*, relation of, to encephalitis in Russian Far East, 70, 239; ecology of, 70.
- Haemaphysalis leporis-palustris*, parasite of, on hares in U.S.A., 4; rabbits immunised against other ticks by, 172.
- Haematobia irritans* (see *Lyperosia*).
- Haematopinus* (on hamsters), extracts of *Stemonia* toxic to, 61.
- Haematopinus asini* (on horses), measures against, in Germany, 171, 172; not transmitting swamp fever in U.S.A., 146.
- Haematopinus equi* (see *H. asini*).
- haemorrhoidalis*, *Gastrophilus*; *Sarcophaga*.
- Hamsters, louse on, 61. (See *Cricetus* and *Cricetus*.)

- hanabusai*, *Anopheles maculatus*.
Hares, ticks on, 4, 98, 94, 242, 243 ; tularaemia in, 14, 15, 95, 138.
Harpalus, host of fowl tapeworm in U.S.A., 146.
Hartomyia (see *Stilobezzia*).
Hawaii, Hydrophilid introduced into, against *Lyperosia irritans*, 185 ; insects introduced into Porto Rico from, against *L. irritans*, 190.
Heat, apparatus for using, against *Cimex lectularius*, 148.
hebracum, *Amblyomma*.
Hedeoma, unsuitable as repellent for mosquitos, 203.
Hedgehogs, tick on, 242.
Helicobia australis, biology and taxonomy of, in Australia, 37.
hemiptera, *Cimex*,
henseli, *Amblyopinus*.
"Herbage Cover," for preventing Anopheline breeding, 88, 163, 212 ; unsuccessful application of, 88.
hermsi, *Ornithodoros*.
heydeni, *Fannia*.
Hilara maura, predacious on Simuliids in Yugoslavia, 16.
Hippoboscids, of British Isles, 248.
hirsuteron, *Aedes* (see *A. sticticus*).
hispanica, *Spirochaeta*.
hispaniola, *Anopheles*.
Hister chinensis, introduction of, into Fiji against house-flies, 155.
hivernus, *Phlebotomus iyengari*.
Hodomys allenii (see *Neotoma*).
Holland, *Anopheles maculipennis* and malaria in, 27, 28, 50-52, 114, 162, 163.
Holoconops bequaerti (*hondurensis*), in Trinidad, 228.
Homalomyia (see *Fannia*).
homini vorax, *Cochliomyia*.
hondurensis, *Holoconops* (see *H. bequaerti*).
Hoplopleura, experimentally transmitting tularaemia, 241.
Hoplopsyllus anomalus, on *Citellus beecheyi* in U.S.A., 106 ; fumigation experiments against, 106, 107.
Hornfly (see *Lyperosia irritans*).
Horses, Anophelines feeding on, 71, 123, 154, 228 ; use of, in traps for mosquitos, 193 ; question of relation of mosquitos, etc., to encephalomyelitis in, 81, 145, 146, 161, 162 ; other blood-sucking Diptera attacking, 154, 249 ; *Hypoderma* infesting, 22, 238, 264 ; lice on, 186, 171 ; experiment with lice and swamp fever of, 146 ; ticks on, 5, 89, 145, 287, 243 ; piroplasmosis of, 5 ; toxicity of dipping fluids to, 206 ; *Onchocerca cervicalis* in, in India, 96 ; relation of *Musca* spp. to dung of, 69, 164.
House-fly (see *Musca domestica*).
Household Insecticides (see Fly-sprays).
Household Pests, book on, 113 ; relation of, to birds' nests, 88.
Houses, value of spraying against Anophelines in, 51, 188.
humanus, *Pediculus*.
Humidity, effects of : on Anophelines, 82, 78, 229, 230 ; on other Diptera, 88, 100, 104, 262 ; on infestation of sheep by blowflies, 112, 185 ; on fleas, 109, 235, 236 ; on ticks, 98, 219, 241, 242, 259.
Hungary, Muscoid flies in, 184 ; tularaemia imported into Italy in hares from, 15.
Hyalomma, species of, on domestic animals in Italy, 89, 40 ; transmitting bovine anaplasmosis, 160.
Hyalomma aegyptium, infected with tularaemia on tortoises, 188 ; question of identity and hosts of, 89, 40.
Hyalomma anatolicum, experimentally transmitting African Coast fever in Kenya, 89.
Hyalomma dromedarii, experimentally transmitting African Coast fever in Kenya, 89 ; in Persia, 150 ; not transmitting *Spirochæta persica*, 150.
Hyalomma impressum, measures against, on cattle in N. Rhodesia, 94.
Hyalomma marginatum, possibly on domestic animals in Italy, 40.
Hydrocyanic Acid Gas, tests and use of, against *Cimex lectularius*, 167, 251, 252 ; against *Pediculoides ventricosus*, 151 ; ventilation of houses fumigated with, 251, 252 ; plant for fumigating railway rolling stock with, 15 ; test for measuring concentration of, 252 ; methyl bromide compared with, against rodents and fleas, 106, 107 ; other fumigants compared with, 167. (See Calcium and Sodium Cyanides.)
Hydrodictyon reticulatum, *Anopheles pseudopunctipennis* associated with, 122.

- Hydrogen-ion Concentration, effects of, on mosquito larvae, 87, 48, 90, 228, 229; of wounds in relation to *Cochliomyia hominivorax*, 192.
- Hydrometra stagnorum*, predacious on Simuliids in Jugoslavia, 16.
- Hylemyia cinerella*, breeding in faeces in Hungary, 184.
- Hymenolepis diminuta*, insect hosts of, in Argentina, 110.
- Hypoderma* (Ox Warble-flies), regulation against, in Germany, 165; in Mongolia and Manchuria, 21, 22; in Poland, 16; in U.S.A., 100, 145; effect of soil moisture on pupae of, 100; effects of infestation by, on cattle, 22, 192; infesting horses, 22, 238, 264; experimental infestation of sheep by, 21; measures against, 100, 145, 165, 166, 189.
- Hypoderma aeratum*, derris against, in goats and sheep in Cyprus, 100.
- Hypoderma bovis*, 199; in Britain, 269; in Cyprus, 99, 100; in France, 238; in Germany, 165; in Manchuria and Mongolia, 21; in Morocco, 264; bionomics and importance of, in Rumania, 198; in U.S.A., 100; infesting cattle, 21, 99, 100, 165, 198; in spinal canal of cows, 192, 224; infesting horses, 238, 264; infesting man, 269.
- Hypoderma crossi*, in goats in India, 244.
- Hypoderma lineatum* (in cattle), in Cyprus, 99, 100; in Denmark, 198, 199; in Germany, 165; in India, 147, 244; in Mongolia and Manchuria, 21; in U.S.A., 100; bionomics of, 21, 147.
- Hypodermatotoxin, 22.
- hyrcanus*, *Anopheles*.
- I.
- icterohacorrhagiae*, *Leptospira*.
ilovaiskii, *Ceratophyllus* (*Oropsylla*).
imerinensis, *Anopheles funestus*.
immitis, *Filaria* (*Dirofilaria*).
implexus, *Anopheles*.
impressum, *Hyalomma*.
incertus, *Copris*.
indefinitus, *Anopheles subpictus*.
 India, Anophelines and malaria in, 6-9, 28, 43, 44, 45, 69, 81, 152, 153, 160, 184, 207, 208, 209, 210, 224, 225, 248, 267; other mosquitos in, 45, 46, 127, 209, 210, 268; parasites of mosquitos in, 8, 160; filariasis in, 44-46; risk of introduction of yellow fever into, 191, 225; *Phlebotomus barraudi* in, 6; *Siphunculina funicola* and conjunctivitis in, 64, 206; house-frequenting flies in, 109; rats, fleas and plague in, 9, 10; pests and diseases of domestic animals and poultry in, 5, 96, 127, 148, 147, 160, 244; (Baluchistan), *Lucilia sericata* in, 135.
- indiana*, *Mansonia* (*Mansonioides*).
indicus, *Phlebotomus squamipleurus*.
 Indo-China, Anophelines and malaria in, 47, 64, 91, 96, 127, 138, 154, 162, 224, 225, 256; other mosquitos in, 28, 47, 213, 255, 256, 263, 269; *Filaria* spp. in man in, 28; *Phlebotomus barraudi* in, 6; *Chrysomyia bezziana* infesting man in, 154.
- Indole, and ammonium carbonate, attractiveness of, for blowflies, 196.
- indubilans*, *Mansonia*.
inermis, *Phlebotomus squamipleurus*.
infantum, *Leishmania*.
infestans, *Triatoma*.
infundibulum, *Choanotenia*.
iniini, *Anopheles*.
Inocarpus edulis, mosquitos associated with, in Fiji, 80.
- Insecticides, review of biological methods of testing, 269. (See Fly-sprays.)
- Insects, book on injurious, and their control in Germany, 238; catalogue of injurious, in Washington, 203; apparatus for studying blood-sucking, 244; haemoflagellates of, 270; relations of parasitic worms to, 58, 110, 146, 189, 190, 247; popular names of, 176.
- insulaeflorum*, *Anopheles*.
intermedia, *Danubiosimulium columbianense*.
intermedius, *Phlebotomus*.
Ipomoea, *Mansonia* associated with, 187.
- Iraq, new relapsing fever spirochaete transmitted by *Ornithodoros asperus* in, 289.
- Irrigation Systems, relation of Anophelines and malaria to, 44, 152, 185.
- irritans, *Lyperosia* (*Haematobia*); *Pulex*.
- irritans, Lucas, *Leptus*.
- irritans, Riley, *Leptus* (see *Trombicula alfreddugesi*).

Italy, Anophelines in, 27, 52, 53, 116, 125, 158, 159, 162, 163, 175, 186; malaria in, 27, 52, 116, 125; *Phlebotomus* and dermal leishmaniasis in, 62, 142, 165, 246; *Pediculoides ventricosus* causing dermatitis in, 66; ticks in, 39, 40, 178; tularaemia in, 15.

Ixodes, possible vector of exanthematic typhus of Brazil, 36; transmitting tularaemia in Russian Union, 241; new species of, in U.S.A., 68, 120; transmitting anaplasmosis of cattle, 160.

Ixodes marmotae, sp. n., on marmots in U.S.A., 120.

Ixodes persulcatus, relation of, to encephalitis in Russian Far East, 70, 239, 240; ecology and reaction to physical factors of, 70, 222.

Ixodes ricinus, in Argentina, 94; in Britain, 92-94, 190, 242, 268; in Italy, 39; in Jugoslavia, 188; in Russia, 242; relation of, to diseases of cattle and sheep, 160, 188, 242; other hosts of, 39, 93, 94, 242, 243; bionomics and factors affecting distribution of, 92-94, 190, 242; measures against, 243.

Ixodes rubicundus, causing paralysis of sheep in Basutoland, 99.

Ixodiphagus texanus, bionomics of, in U.S.A., 4.

Ixovotoxin, 149.

iyengari, *Phlebotomus*.

J.

janthinomys, *Haemagogus* (see *H. capricorni*).

Janthinosoma (see *Psorophora*).

Japan, *Aedes* sp. in, 165; Oedemerid causing dermatitis in, 143; *Lyperosia irritans* on domestic animals in, 154.

Japanese Mandated Islands, Arthropods attacking man in, 256.

japonicus, *Anopheles lindesayi*.

jelskii, *Pheidole fallax*.

jenningsi, *Trimenopon*.

jeyporiensis, *Anopheles*.

Jugoslavia, *Danubiosimulium columbaceense* and its natural enemies in, 15, 16, 85, 86; mosquitos in, 127; Muscoid flies in, 168; ticks and diseases of domestic animals in, 149, 188.

Jurečekia asphaltina, destroying fleas in rodent burrows in Russia, 59.

K.

Kangaroos, tick on, in Australia, 249.

karamellahiei, *Rivoltasia*.

kauntzeum, *Simulium*.

Kenya, Ceratopogonids in, 226; fleas in, 226; *Glossina* spp. in, 88, 89, 98, 226; sleeping sickness in, 98, 266; mosquitos in, 47, 88, 160, 226; Simuliids and *Onchocerca volvulus* in, 267; pests and diseases of domestic animals in, 88, 89, 159, 160.

Kerteszia (see *Anopheles*).

kochi, *Anopheles*.

kolambunganensis, *Anopheles*.

Korea, moth causing dermatitis in, 95.

L.

labranchiae, *Anopheles maculipennis*.
lacteolus, *Dermacentor marginatus*.
laemica, *Calliphora*.

laevis, *Canthon* (see *C. pilularius*); *Cnemidopter*.

lahorensis, *Ornithodoros*.

lanei, *Anopheles (Nyssorhynchus)*.

langeroni, *Phlebotomus*.

lanaria, *Cochliomyia (Musca)*.

Larmuth Apparatus, for spraying aircraft, 48, 49, 119.

lateralis, *Aedes*.

latifrons, *Calliphora*.

Latrodectus mactans, 190; food of, in U.S.A., 224.

Lauryl Thiocyanate, 251. (See Thiocyanates.)

Lebias dispar (see *Aphanius*).

Lebistes, value of, against mosquito larvae in India, 8.

Lebistes reticulatus, attempted acclimatisation of, against mosquito larvae in Uzbekistan, 76, 77.

lectularius, *Cimex*.

leesoni, *Anopheles*.

Leishmania, strain of, in Central Asia, 76; method of feeding sandflies on suspensions of, 199.

Leishmania brasiliensis, 245.

Leishmania chagasi, causing visceral leishmaniasis in Brazil, 66, 158, 200, 245; considered identical with *L. infantum*, 158, 245; experiments with *Phlebotomus* spp. and, 200, 245.

Leishmania donovani, 245.

Leishmania infantum, behaviour of, in *Phlebotomus* spp., 200; *L. chagasi* (q.v.) considered identical with, 158, 245.

- Leishmania tropica*, 245 ; in *Phlebotomus perifiliwei* in Italy, 62, 165 ; strains of, from Crete and Palestine, 108, 199 ; experiments with *Phlebotomus* spp. and, 108, 165, 199 ; *Phlebotomus* not considered vector of, 183 ; mechanical transmission of, by *Stomoxys*, 183, 184, 200.
- Leishmaniasis, forms and transmission of, in Russian Union, 76.
- Leishmaniasis, Cutaneous, in Italy, 62, 142, 165, 246 ; and *Phlebotomus*, 62, 183, 142, 165, 189, 246. (See *Leishmania tropica*.)
- Leishmaniasis, Visceral, studies of Brazilian form of, 66, 157, 158, 200, 245, 246 ; and *Phlebotomus*, 66, 158, 189, 245, 246 ; in animals, 66, 158.
- Lemmings, relation of mosquitos and tularaemia to, in Swedish Lapland, 128, 188.
- Lemma*, unfavourable to Anopheline larvae, 233 ; protecting Anopheline larvae from fish, 153.
- Lemon Grass, toxicity of oil of, to eggs of *Cochliomyia*, 259.
- lenti*, *Phlebotomus*.
- lepidum*, *Simulium*.
- leporis-palustris*, *Haemaphysalis*.
- Leprosy, experiments with Arthropods and, 262.
- Leptoconops bequaerti* (see *Holoconops*).
- Leptopsylla musculi* (see *L. segnis*).
- Leptopsylla segnis* (on rats), in China, 92, 235, 236 ; in England, 88 ; seasonal prevalence of, 235, 236.
- Leptospira icterohaemorrhagiae*, experiments with *Triatoma infestans* and, 87.
- Leptus irritans*, Lucas, doubtful identity of, 5.
- Leptus irritans*, Riley (see *Trombicula alfreddugèsi*).
- Leptus similis* (see *Trombicula alfreddugèsi*).
- lesteri*, *Anopheles hyrcanus*.
- Lethane 384, composition of, 251. (See *Thiocyanates*.)
- leucocelaenus*, *Aëdes*.
- Leucocytozoön*, Simuliids transmitting, to poultry, 189.
- Leucocytozoön simondi* (*anatis*), synonymy of, 64.
- leucosphyrus*, *Anopheles*.
- leucotaenius*, *Aëdes*.
- Libya, ticks in, 63.
- Lice, on domestic animals, 94, 99, 136, 146, 171, 196, 249 ; on fowls, 89 ; measures against, 89, 94, 171, 196 ; on deer, 224 ; on monkeys, 130, 140 ; on rats, 96, 262 ; rickettsiae in, on guineapigs, 26 ; experiments with diseases and, 180, 140, 146, 241, 262 ; tests of extracts of *Stemonia tuberosa* on, 61 ; (Mallophaga), bibliography of, 120 ; classification of, 136 ; on man (see *Pediculus humanus* and *Phthirus pubis*).
- Light, reactions of *Musca domestica* to wave lengths of, 184.
- Light-traps, for mosquitos, 214, 215, 216.
- Limatus*, associated with yellow fever in Brazil, 121.
- Lime-sulphur Dips, tests of toxicity of, to animals, 206.
- Limnaea ovata*, value of, against Anopheline larvae, 76.
- limosus*, *Anopheles vagus*.
- lindesayi*, *Anopheles*.
- lineatum*, *Hypoderma*.
- Linognathus stenopsis* (*africanus*), on sheep in Basutoland, 99.
- Linseed Oil, in mixture against *Amblyomma maculatum*, 101.
- Liponyssus*, experiments with *Spirochaeta duttoni* and, 128, 257.
- Liponyssus bacoti*, 128, 190.
- Liponyssus nagayoi*, 128 ; experiments with *Spirochaeta duttoni* and, 257.
- Liponyssus sylviarum*, bionomics and control of, on fowls in Canada, 38 ; other hosts of, 38, 39.
- litorale*, *Danubiosimulium columbacense*.
- Lonchocarpus*, preparations of, for treating mange, 41.
- longiceps*, *Pedicinus*.
- longicornis*, *Dioctria*.
- longipalpis*, *Anopheles* ; *Mansonia* ; *Phlebotomus*.
- longipennis*, *Glossina*.
- longipes*, *Phlebotomus*.
- Loochoo Islands, *Filaria bancrofti* in, 257 ; *Pulex irritans* in, 257.
- lophoventralis*, *Aëdes*.
- Louping-ill, *Ixodes ricinus* transmitting, in sheep in Britain, 242 ; diseases of man compared with, 224.
- Lucilia caesar*, in Hungary, 184.
- Lucilia cuprina*, studies on, infesting sheep in Australia, 195, 196.
- Lucilia eximia*, infesting fowls in Brazil, 110.
- Lucilia sericata*, in Baluchistan, 185 ; in New Zealand, 185 ; in U.S.A., 101 ; infesting domestic

- animals, 101, 135 ; intestinal myiasis not caused by, 108 ; use of, for treating wounds, etc., 187, 199 ; action of enzyme in, in wounds, 199 ; chemotropic reactions of, 166 ; physiology of development and diapause in, 64, 83.
ludlowi, auct., *Anopheles* (see *A. sundaicus*).
lutzi, *Neivamyia* ; *Psorophora*.
 Lymphocytic Choriomeningitis, transmission of, by *Aedes aegypti*, 231.
lynchi, *Cochliomyia* (see *C. macellaria*).
Lyngbya, *Anopheles sundaicus* associated with, 43.
Lyperosia irritans, in Hawaii, 135, 190 ; on domestic animals in Japan, 154 ; in Porto Rico, 158, 190 ; natural enemies and biological control of, 135, 156, 190 ; equipment for feeding, 56.
 Lysol, against *Oestrus ovis*, 145.

M.

- Macacus rhesus*, lymphocytic choriomeningitis in, 231 ; experiments with relapsing fever and, 140 ; experiments with yellow fever and 121, 161, 238 ; louse on, 140.
macedonicus, *Phlebotomus* (see *P. perfoliwi*).
macellaria, *Cochliomyia*.
Macroptilum aethiopicum, male of, 84.
macrorchis, *Prosthogonimus*.
mactans, *Latrodectus*.
maculata, *Eutriatoma*.
maculatum, *Amblyomma*.
maculatus, *Anopheles*.
maculipalpis, *Anopheles*.
maculipennis, *Anopheles*.
 Madagascar, Anophelines of, 91.
major, *Phlebotomus*.
 Malaria, in Abyssinia, 117, 137 ; in Portuguese E. Africa, 212 ; in S. Africa, 213 ; in Algeria, 34, 118 ; in Argentina, 12, 247 ; in Bahrein Islands, 153, 154 ; in Brazil, 125, 126, 218, 227, 228 ; in China, 130, 234 ; in Belgian Congo, 137, 144 ; in Egypt, 137 ; in Germany, 50 ; in Br. Guiana, 229, 230 ; in Holland, 27, 28, 51, 52 ; in India, 6, 7, 9, 28, 44, 81, 152, 153, 207, 208, 209, 210, 224, 225, 248, 267 ; in Netherlands

- Indies, 16, 126 ; in Indo-China, 64, 91, 96, 127, 162, 225, 256 ; in Italy, 27, 52, 53, 116, 125 ; in Malaya, 10, 11, 12, 46, 126, 210 ; in Mexico, 80, 81, 122, 123 ; in Morocco, 78, 117 ; in New Hebrides, 212 ; in Philippines, 163, 164, 253 ; in Portugal, 185 ; in Rumania, 254, 255 ; in Russian Union, 70, 71, 72, 73, 74, 127, 181, 182, 220, 221, 223 ; in Sudan, 87 ; in Sweden, 26 ; in Tanganyika Territory, 31, 32, 89, 90 ; in Tunisia, 118 ; in U.S.A., 29, 30 ; in Venezuela, 43 ; and mosquitos, 6, 7, 9, 10, 11, 12, 26, 27, 28, 30, 32, 34, 44, 46, 50, 51, 52, 71, 72, 73, 74, 78, 79, 80, 81, 87, 89, 90, 91, 92, 115, 116, 117, 118, 122, 123, 125, 126, 127, 137, 139, 152, 153, 154, 162, 163, 164, 181, 182, 185, 186, 207, 208, 209, 210, 211, 212, 213, 218, 220, 223, 225, 227, 228, 229, 230, 234, 247, 248, 253, 254, 255, 256, 267 ; experiments with Anophelines and, 74, 78, 79, 132, 137, 186, 194, 228, 232 ; use of Anophelines for inducing, 124 ; factors affecting transmission of, by Anophelines, 6, 32, 50, 51, 74, 79, 223, 256, 267 ; relation of maxillary indices to infectibility of Anophelines with, 114 ; effect of drugs on infection of Anophelines with, 115, 152 ; persistence of, in Anophelines, 162 ; possible relation of Culicines to 92 ; method of staining oöcysts of, in mosquitos, 247 ; relation of domestic animals to incidence of, 52, 153, 211, 212 ; statistical and other methods of investigating epidemiology of, 82, 126 ; books on vectors and control of, 139, 210 ; history of control of, 30 ; prevention of, in engineering projects, 184 ; question of control of, in partly immune communities, 31, 32 ; measures against, among troops in the field, 96 ; studies of parasites of, infecting apes, 198, 246. (See *Plasmodium* spp.)
malariae, *Plasmodium*.
 Malaya, Anophelines and malaria in, 10, 11, 12, 46, 126, 207, 210 ; pupae of Anophelines of, 234 ; other mosquitos and *Filaria* spp. in, 11, 12, 92 ; new *Phlebotomus* in, 6.
malayensis, *Phlebotomus iyengari*.
malayi, *Filaria* (*Microfilaria*).

- Malignant Tertian Malaria (see *Plasmodium falciparum*).
 Man, myiasis in, 107, 144, 154, 189, 265, 266, 269; insects causing dermatitis in, 95, 143, 256; mites infesting, 5, 38, 39, 66, 150, 256; symptoms caused by *Ornithodoros gurneyi* in, 249.
 Manchuria, blood-sucking insects of, 108, 148; *Musca domestica* in, 108; plague in, 109; *Hypoderma* infesting cattle in, 21.
 Mange, measures against, on domestic animals, 41. (See *Psoroptes*.)
 Mangroves, utilisation of, against Anopheline larvae, 9.
mangyanus, *Anopheles*.
Mansonia, in Brazil, 193; in Ceylon, 178; carried to Florida in aeroplanes, 215; in Netherlands Indies, 187; in Indo-China, 255; in Malaya, 11, 92; characters of Malayan species of, 92; in Travancore, 45, 46; relation of, to *Filaria malayi*, 11, 45, 92, 178; experiments with *Filaria* spp. and, 11, 45; experimentally transmitting tularaemia, 241; breeding habits and host plants of, 11, 45, 46, 92, 178, 187, 255; method of collecting larvae of, 214; experimental feeding of, 193; precautions against, 92.
Mansonia annulata, in Borneo, 187; in Malaya, 11; infected with *Filaria malayi*, 11.
Mansonia annulifera, in Netherlands Indies, 187; in Indo-China, 255; in Malaya, 11; in Travancore, 45; relation of, to *Filaria* spp., 11, 45; recorded as *M. longipalpis*, 255.
Mansonia annulipes (see *M. longipalpis*).
Mansonia crassipes, larva of, in Borneo, 187.
Mansonia indiana, in Borneo, 187; bionomics of, in Indo-China, 255; in Malaya, 11; in Travancore, 45; relation of, to *Filaria malayi*, 11, 45.
Mansonia indubitans, 215.
Mansonia longipalpis, in Borneo, 187; erroneously recorded from Indo-China, 255; relation of, to *Filaria malayi* in Malaya, 11; breeding habits of, 11, 187.
Mansonia perturbans, study of, in U.S.A., 214.
Mansonia titillans, 215.
Mansonia uniformis, in Ceylon, 178; in Netherlands Indies, 187; in Indo-China, 255; in Malaya, 11; in Travancore, 45; relation of, to *Filaria malayi*, 11, 45, 178; bionomics of, 11, 187.
Mansonioides (see *Mansonia*).
marginale, *Anaplasma*.
marginatum, *Hyalomma*.
marginatus, *Dermacentor*.
mariae, *Aedes*.
Marmota, new tick on, in U.S.A., 120.
marmotae, *Ixodes*.
 Marseilles Fever, transmitted by *Rhipicephalus sanguineus* in Russia, 240, 241; probably in dogs, 241.
marshalli, *Anopheles*.
marteri, *Anopheles*.
martini, *Phlebotomus*.
 Martinique, *Anopheles tarsimaculatus* in, 34, 211.
mastitidis, *Streptococcus*.
matogrossensis, *Anopheles*.
maura, *Hilara*.
mauritanicus, *Anopheles* (see *A. coustani*).
 Medical Entomology, text-books on, 40, 189.
 Medical Zoology, index catalogue of, 192.
mediopunctatus, *Anopheles*.
megacephala, *Chrysomya*.
Megarhinus splendens, utilisation of, against *Aedes scutellaris* in Fiji, 80.
Megaselia agarici, asthma due to sensitisation to, 248.
megistus, *Panstrongylus*.
melanogaster, *Drosophila*.
melanoon, *Anopheles maculipennis*.
melas, *Anopheles gambiae*.
Melophagus ovinus (on sheep), in Australia, 196; in Basutoland, 99; in Britain, 242; dips against, 196.
 Mercury Bichloride, reactions of *Musca domestica* to, 103.
 Mermitids, in Simuliid larvae in Canada, 250; in mosquitos in India, 8.
mesodentatus, *Haemagogus*.
messeae, *Anopheles maculipennis*.
metcalfi, *Anopheles oswaldoi*.
 Methyl Bromide, fumigation with, against fleas and rodents, 106, 107, 189.
 Methylated Spirit, in mixture against *Psoroptes caprae*, 147.

- Methylene Blue, use of, in testing fly-sprays, 268 ; for staining mosquito larvae, 80.
- Mexico, Anophelines and malaria in, 80, 81, 122, 123 ; mite infesting man in, 5 ; scorpions in, 96 ; ticks in, 160, 195, 239 ; *Triatoma pallidipennis* and *Trypanosoma cruzi* in, 264 ; new spirochaete in man in, 195.
- Microfilaria malayi* (see *Filaria*).
- Microlichus avus*, infesting birds, 178.
- microplus*, *Boophilus annulatus*.
- Microthrombidium alfreddugèsi* (see *Trombicula*).
- Micrurus*, mosquitos feeding on, in Sweden, 128.
- Mill-ponds, control of Anopheline larvae in, 180.
- minimus*, *Anopheles*.
- minutus*, *Phlebotomus*.
- missiroli*, *Anopheles claviger*.
- Mites, infesting man, 5, 38, 39, 66, 150, 256 ; on domestic animals, 40, 41, 89, 147 ; relation of, to sheep tapeworm, 145 ; on fowls, 38, 63, 110, 160 ; transmitting spirochaetosis of poultry, 63 ; on other birds, 38, 178 ; measures against, 39, 41, 147 ; on rats, 38, 96, 262 ; experiments with leprosy and, 262 ; experiments with *Spirochaeta duttoni* and, 128, 257 ; and tularemia, 241 ; parasitising Diptera, 27, 250 ; classification of, 5 ; popular names of, 176.
- molestus*, *Culex pipiens*.
- Mongolia, *Hypoderma* infesting cattle and horses in, 21, 22.
- Moniezia expansa*, relation of mites to, in sheep in U.S.A., 145.
- Monkeys, experimentally infected with Brazilian visceral leishmaniasis, 158 ; experiments with relapsing fever and, 180, 140 ; experiments with *Trypanosoma gambiense* and, 191 ; possibly acquiring yellow fever by feeding on insects, 151, 152 ; *Pedicinus* on, 180, 140. (See *Macacus rhesus*.)
- Monopsyllus* (see *Ceratophyllus*).
- montanus*, *Ceratophyllus (Diamanus)*.
- Morellia*, carrying eggs of *Dermatobia hominis* in Brazil, 110.
- Morocco, Anophelines and malaria in, 78, 117 ; *Hypoderma bovis* infesting horses in, 264.
- morsitans*, *Glossina*.
- morsus-muris*, *Spirochaeta*.
- Mosquito Larvae, breeding places of, 6, 7, 10, 11, 12, 13, 32, 33, 34, 43, 44, 45, 46, 50, 52, 55, 63, 71, 72, 173, 75, 76, 78, 80, 81, 87, 88, 90, 92, 114, 117, 122, 123, 126, 127, 128, 151, 152, 153, 158, 159, 163, 164, 165, 182, 183, 187, 207, 210, 211, 212, 214, 216, 221, 225, 226, 228, 229, 230, 233, 253, 254, 255, 256, 257, 259 ; physico-chemical factors related to, 8, 9, 11, 30, 38, 37, 48, 46, 50, 52, 53, 75, 90, 114, 125, 158, 159, 165, 228, 229, 230, 254, 255 ; relation of aquatic plants to (see also Algae), 11, 13, 45, 46, 71, 75, 87, 153, 178, 187, 214, 233, 255, 256 ; predaceous enemies of (see also Fish), 29, 76, 80, 90 ; not attacked by *Bufo marinus*, 80 ; value of aquatic birds against, 175 ; parasites of, 8, 27, 65, 96 ; mode of feeding of, 68, 224, 248 ; influence of nutrition on adults reared from, 26 ; anal papillae of, 37, 38, 55 ; larvicides against (see also Oils and Paris Green), 53, 68, 156, 207, 209, 232 ; hydro-technical measures against (see also Drainage), 7, 9, 52, 126, 207, 211, 221, 253 ; other measures against, 13, 30, 33, 81, 90, 159, 178, 180, 185, 211, 229, 247, 253 ; methods of collecting and studying, 214, 233 ; method of staining, to recognise adults from, 79, 80 ; use of, for evaluating pyrethrum, 64.
- Mosquito Nets, 50, 92, 164.
- Mosquitos*, in Italian E. Africa, 117, 137, 175, 176 ; in Portuguese E. Africa, 212 ; in S. Africa, 212, 213 ; in French W. Africa, 26, 263 ; in Albania, 158, 186 ; in Algeria, 33, 34, 69, 118, 120, 176, 213, 233, 248 ; in Argentina, 12, 140, 247 ; in Australia, 37, 38 ; in Bahrein Islands, 153, 154 ; in Brazil, 18, 40, 110, 121, 125, 126, 140, 198, 218, 226, 227, 228 ; in Britain, 54, 116, 191, 232 ; of British Isles, 243 ; in Canada, 29, 203 ; in Ceylon, 178, 207 ; in China, 82, 124, 130, 158, 179, 180, 234, 235, 255, 256 ; in Colombia, 139, 140 ; in Belgian Congo, 37, 186, 202 ;

* For relation to disease, see under Encephalomyelitis (Equine), Filariasis, Fowl-pox, Lymphocytic Choriomeningitis, Malaria, Paratyphoid, Rift Valley Fever, Tularemia, Yellow Fever.

in Corsica, 151 ; in Costa Rica, 144 ; in Cyprus, 232 ; in Egypt, 120, 137, 207 ; in Formosa, 124, 130, 177 ; in France, 15, 113, 139, 151 ; in Germany, 27, 49, 50, 54, 77, 78, 124, 158 ; in Gold Coast, 47 ; in Greece, 14, 54 ; in Br. Guiana, 140, 229, 230 ; in Fr. Guiana, 34, 210, 248 ; in Holland, 27, 28, 50-52, 114, 162, 163 ; in India, 6-9, 28, 43, 44, 45, 69, 81, 152, 153, 160, 207, 208, 209, 210, 225, 248, 263, 267 ; in Netherlands Indies, 64, 126, 144, 159, 178, 187, 191, 234 ; in Indo-China, 28, 47, 64, 91, 127, 138, 154, 162, 213, 224, 225, 255, 256, 263, 269 ; in Italy, 27, 52, 53, 116, 125, 158, 159, 162, 163, 175, 186 ; in Japan, 165 ; in Japanese Mandated Islands, 258 ; in Jugoslavia, 127 ; in Kenya, 47, 88, 160, 226 ; in Malaya, 10, 11, 12, 46, 126, 207, 210, 234 ; in Manchuria, 108, 143 ; in Mexico, 80, 81, 122, 123 ; in Morocco, 78, 117 ; in New Hebrides, 212 ; in New Zealand, 88 ; in Nigeria, 47 ; in Palestine, 54 ; in Panama, 140 ; in Philippines, 163, 164, 253 ; in Poland, 186 ; in Portugal, 185, 233 ; in Rumania, 253-255 ; in Russian Union, 67, 68, 69, 70, 71, 72, 78, 74, 75, 76, 113, 114, 127, 173, 174, 175, 180-183, 184, 219, 220, 221, 222, 223, 224 ; of Sinai Peninsula, 120 ; in Sierra Leone, 65, 130, 131 ; in Spain, 96, 213 ; in Anglo-Egyptian Sudan, 47, 87 ; in Sweden, 26, 95, 128, 188 ; in Tanganyika Territory, 32, 89, 90 ; in Tunisia, 118 ; in Uganda, 226 ; in U.S.A., 28-31, 105, 106, 121, 128, 151, 156, 161, 167, 191, 194, 214, 215, 216, 217, 230, 231, 257, 259 ; in Venezuela, 43 ; in West Indies, 30, 34, 211 ; carrying eggs of *Dermatobia hominis*, 110 ; spirochaete in, 232 ; relation of, to domestic animals, 12, 52, 63, 71, 72, 73, 74, 77, 114, 123, 125, 128, 153, 154, 162, 163, 164, 181, 182, 211, 212, 213, 220, 229 ; review of relation of, to diseases of animals, 127 ; doubtful effect of, on milk production in cows, 194 ; stimuli inducing feeding of, 63 ; function of mouth-parts of, 191 ; significance of maxillary index of, 114 ; studies on blood-digestion in, 174 ; resting places of, 71, 78, 164, 252 ; hibernation of, 50, 54, 55, 68, 72, 78, 76, 77, 91, 113, 114, 121, 122, 128, 151, 156, 179, 181 ; effects of temperature and humidity on, 73, 174, 229, 230 ; factors influencing eggs and oviposition of, 26, 77, 139, 156, 183, 213, 223, 231, 257, 262 ; fungi infesting, 8, 65, 96 ; other parasites of, 8, 27, 160 ; carriage and control of, in aeroplanes, 31, 47-49, 87, 118-120, 215 ; sprays against, 31, 48, 49, 51, 90, 119, 138, 215 ; apparatus for testing sprays on, 267 ; repellents for, 14, 29, 124, 203 ; screening against, 33, 50, 92, 159, 164 ; materials for screening against, 131 ; traps for, 193, 214, 215, 216, 228, 253 ; other measures against, 211 ; action of oils on eggs of, 216 ; conservation problems related to control of, in marshes, 29, 167, 215 ; control of, during military operations, 15 ; precautions against, in engineering works, 184 ; precautions against, on railways, 33 ; text-book on control of, 210 ; review of work on, in 1937, 29 ; methods of staining, 79, 80, 90 ; experimental rearing and feeding of, 124, 193, 213, 227, 244, 262, 263, 269 ; technique of dissecting, 64 ; methods of preserving eggs of, 223, 248 ; classification and new species of, 13, 34, 40, 63, 120, 121, 140, 144, 160, 163, 175, 176, 191, 210, 211, 224, 226, 227, 234, 248.

moubata, *Ornithodoros*.

moucheti, *Anopheles*.

Mules, tick on, 145.

Mules' Operation, 62, 197, 198.

multicolor, *Anopheles*.

multidentatum, *Simulium*.

Mus norvegicus, fleas on : in China, 91, 92, 235 ; in India, 10 ; in Manchuria, 108 ; and plague, 10.

Mus rattus, fleas on, in India and China, 10, 235, 236 ; importance of, in relation to plague, 236.

Mus rattus alexandrinus, fleas on, in China, 235.

Mus rattus diardii, parasites of, in Java, 96.

Musca, carriage of bacteria by, in Philippines, 164 ; habits of, in S. Rhodesia, 249 ; investigation on variation of cholera vibrios in, 168 ; methods of refuse disposal

- against, 165 ; classification of, 85, 110.
Musca arcuata (see *M. pruna*).
Musca domestica (House-fly), 189 ; in Argentina, 266 ; habits of, in Hungary and Jugoslavia, 184, 168 ; overwintering of, in Indian hills, 109 ; in Manchuria, 108 ; parasites of, in Porto Rico, 190 ; bionomics and control of, in Russia, 69 ; host of fowl tape-worm in U.S.A., 146 ; effect of overcrowding on larvae of, 174, 175 ; tests of action of calcium cyanamide on, 84, 143 ; use of, for testing fly-sprays, 17, 18, 22-25, 56, 57, 105 ; technique of rearing, for insecticide tests, 56, 57 ; tests of chemotropic reactions of, 102, 108, 166, 250 ; reactions of, to light of different wave lengths, 184 ; carriage of, in aeroplanes, 215.
Musca domestica vicina, Histerid introduced into Fiji against, 155 ; bionomics of, in India and Philippines, 109, 164.
Musca laniaria (see *Cochliomyia*).
Musca nebula, bionomics of, in India and Philippines, 109, 164.
Musca pruna, carrying eggs of *Dermatobia hominis* in Brazil, 110 ; synonymy of, 110.
Musca pumila, troublesome to sheep in Australia, 197, 198.
Musca sorbens, breeding habits of, in Philippines, 164.
Musca vetustissima (see *M. pumila*).
muscidarium, *Spalangia*.
 Muscids, British blood-sucking species of, 243 ; collections of, from Ethiopean Region, 226.
Musqina stabulans, habits of, in Hungary, 184.
musculi, *Leptopsylla* (see *L. segnis*).
 Mustard, toxicity of oil of, to eggs of *Cochliomyia*, 259.
mutans, *Cnemidocoptes*.
 Myelitis, *Hypoderma bovis* associated with, in cows, 192.
 Myiasis, in man, 107, 144, 154, 189, 265, 266, 269 ; experiments on production of intestinal, 107, 108.
myrmecobii, *Echidnophaga*.
mysorensis, *Anopheles stephensi*.
- N.
- nagayoi*, *Liponyssus*.
najas, *Gerris*.
- Naphtha Vapour, use of, against *Cimex lectularius*, 62.
 Naphthalene, ineffective against *Liponyssus sylviarum*, 39.
natalator, *Gyrinus*.
neavei, *Simulium*.
nebulo, *Musca*.
neivai, *Anopheles (Kerteszia)*.
Neivamyia lutzi, carrying eggs of *Dermatobia hominis* in Brazil, 110.
neomaculipalpus, *Anopheles*.
Neopsylla setosa, persistence of, in rodent burrows in Russia, 60, 170.
Neotoma spp., Triatomids associated with, in U.S.A. and Mexico, 132, 264.
Nepenthes, mosquito breeding in, 256.
 Netherlands Indies, mosquitos in, 64, 126, 144, 159, 178, 187, 191 ; larval characters of mosquitos of, 64, 284 ; filariasis in, 178, 187 ; malaria in, 16, 126 ; *Sarcophaga* in, 16 ; parasites of rats in, 98 ; plague in, 176 ; Histerid introduced into Fiji from, 155.
 New Hebrides, *Anopheles punctulatus* and malaria in, 212.
 New Zealand, mosquitos in, 38 ; blowflies infesting sheep in, 185 ; parasite of blowflies in, 169.
nicanus, *Ceratophyllus (Nosopsyllus)*.
nicollei, *Ornithodoros*.
 Nicotine, in mixture against lice on horses, 171.
 Nicotine Sulphate, against parasites of poultry, 39 ; use of, in blowfly traps, 103, 196.
 Nigeria, *Aedes aegypti* in, 47 ; *Glossina* spp. in, 19, 97, 201, 261, 266 ; sleeping sickness in, 97, 266.
nigerrimus, *Anopheles hyrcanus*.
nigribarba, *Calliphora vomitoria*.
nigripes, *Anopheles* (see *A. plumbeus*).
nigromaculis, *Aedes*.
nigroparvum, *Simulium*.
nilgiricus, *Anopheles lindesayi*.
nili, *Anopheles*.
nipponii, *Aedes vexans*.
nitens, *Otocentor (Dermacentor)*.
noguchii, *Phlebotomus*.
noroeensis, *Anopheles oswaldoi*.
Nosema, infesting mosquito larvae in India, 8.
Nosema simulii (see *Thelohania varians*).
Nosopsyllus (see *Ceratophyllus*).
notatus, *Phlebotomus*.
novumbrosus, *Anopheles*.

nubica, *Xenopsylla*.
nuttalli, *Dermacentor*.

Nyasaland, *Glossina brevipalpis* and trypanosomiasis in, 260, 261; Simuliids and onchocercosis in, 155.

Nycteribiids, of British Isles, 243.
Nyssorhynchus (see *Anopheles*).

O.

obturbans, *Armigeres*.

occidentalis, *Xenopsylla*.

Ochlerotatus (see *Aedes*).

Odontocileus, parasites of, in British Columbia, 224.

Oedogonium, *Anopheles sundaicus* associated with, 43.

Oestrus ovis (in sheep), in Basutoland, 99; Lysol against, in U.S.A., 145.

ogasawarensis, *Eobia cinereipennis*. Oils (against mosquito larvae), mixtures and types of, 12, 19, 156, 178, 258, 259; value of miscible, in rice-fields, 258; study of spreading powers of, 259; methods of applying, 81, 124, 222; device for applying, to flushing cisterns, 14; factors affecting action of, 12; behaviour of Anopheline larvae in water treated with, 221; action of, on mosquito eggs, 216; specification for, in dressing against blowflies, 258; in repellent against *Culicoides*, 166; in mixture against *Psoroptes caprae*, 147. (See Fly-sprays.)

Olfactometer, for use with houseflies, 168.

Onchocerca cervicalis, in horses in India, 96.

Onchocerca volvulus, and Simuliids in E. Africa, 155, 176, 267.

Onchocercosis, 189, 202.

Ophyra analis, ovipositing on sheep in New Zealand, 185.

Opossums, Staphylinid parasite of, in Brazil, 218; Brazilian exanthematic typhus in, 86.

orientalis, *Blatta*; *Phlebotomus langeroni*.

ornatus, *Aedes* (see *A. geniculatus*).

Ornithocoris toledo, in fowl house in Brazil, 244; not attacking man, 244.

Ornithodoros, associated with *Spirochaeta carateum* in Mexico, 195; ability of species of, to transmit various spirochaetes, 239.

Ornithodoros asperus, new spirochaete transmitted by, in Iraq, 239.

Ornithodoros coreaceus, in Mexico, 239; experimentally transmitting *Spirochaeta persica*, 239.

Ornithodoros delanöei acinus, subsp. n., in Br. Somaliland, 96.

Ornithodoros erraticus, transmitting *Spirochaeta hispanica* in Mediterranean Basin, 239; not transmitting *S. babylonensis*, 239.

Ornithodoros gurneyi, habits of, in Australia, 249; effects of bite of, on man, 249.

Ornithodoros hermsi, transmission of relapsing fever by, in California, 4, 181, 189; experiments with *Trypanosoma cruzi* and, 183.

Ornithodoros lahorensis, in Persia, 150; experimentally transmitting tularaemia in Turkey, 148; not transmitting *Spirochaeta persica*, 150.

Ornithodoros moubata, studies on transmission of *Spirochaeta duttoni* by, 111, 141, 142; effect of humidity on immature stages of, 259.

Ornithodoros nicollei, in Mexico, 239; spirochaetes experimentally transmitted by, 239.

Ornithodoros papillipes (see *O. tholozani*).

Ornithodoros savignyi, experiments with louse-borne relapsing fever and, 129.

Ornithodoros tholozani, in Central Asia and Palestine, 239; in Persia, 150; transmitting *Spirochaeta persica*, 150, 239; not transmitting *S. babylonensis*, 239. *Ornithodoros turicata*, and relapsing fever in Texas, 140; experiments with *Spirochaeta* spp. and, 140, 141, 239; experiments with *Trypanosoma cruzi* and, 188; bionomics of, 140, 141.

Oropsylla (see *Ceratophyllus*).

Orthelia pruna (see *Musca*).

Orthodichlorobenzene, limitations of use of, against *Cimex lectularius* in Britain, 62.

Orthopodomyia pulchripalpis (albionensis), breeding in tree-holes in Yugoslavia, 127.

Oscillatoria, *Anopheles sundaicus* associated with, 48.

Osteomyelitis, treatment of, with blowfly larvae, etc., 187.
oswaldoi, *Anopheles*.

Otocentor, gen. n., 224.
Otocentor nitens, 224.
ovale, *Plasmodium*.
ovinus, *Melophagus*.
ovis, *Oestrus*; *Psoroptes*.
 Owls, spread of rodent fleas by, 204, 205.

P.

Pachycrepoideus dubius, parasite of *Musca domestica* in Porto Rico, 190.
 Palaeartic Region, fleas of, 63; Tabanids of, 192.
 Palestine, *Culex pipiens molestus* in, 54; *Phlebotomus papatasii* transmitting *Leishmania tropica* in, 108; *Ornithodoros tholozani* and relapsing fever in, 239.
pallens, *Culex pipiens*.
pallidipennis, *Triatoma*.
pallidipes, *Glossina*.
pallidus, *Anopheles*.
palpalis, *Glossina*.
 Panama, new *Aedes* in, 140.
Panchax panchax, question of value of, against mosquito larvae in India, 8, 153.
Panstrongylus megistus, in Brazil, 35; experiment with *Trypanosoma cruzi* and, 110; experiments with typhus group fevers and, 35, 157.
papatasii, *Phlebotomus*.
papillipes, *Ornithodoros* (see *O. tholozani*).
Parabezzia (see *Stilobezzia*).
 Paradichlorobenzene, ineffective against *Liponyssus sylviarum*, 39.
 Paraffin Wax, in dressing against blowflies, 258.
 Paratyphoid Bacteria, experiments with insects and, 67, 148.
Parcoblatta pensylvanica, in houses in U.S.A., 128.
Paregle cinerella (see *Hylemyia*).
 Paris Green, dusting with, against Anopheline larvae, 7, 18, 30, 68, 87, 123, 125, 154, 159, 163, 233; formulae and carriers for, 7, 68, 87, 233; aeroplanes for applying, 30; method of spraying with, against Anopheline larvae, 232; balls for using, against mosquito larvae in sullage water, 123; effect of, on rice, 123; fish not affected by, 159; effect of, on *Limnaea ovata*, 76.
 Parsley, toxicity of oil of, to eggs of *Cochliomyia*, 259.

parva, *Theileria*.
parvicornis, *Ulosomia*.
Pasteurella pestis (see *Bacillus*).
pattoni, *Anopheles*.
paulistensis, *Anopheles darlingi*.
Pedicinus (on monkeys), experiments with relapsing fever and, 180, 140.
Pedicinus longiceps, 140.
Pediculoides ventricosus (causing dermatitis), bionomics and control of, in Bulgaria, 150; associated with *Anobiid* in furniture in Italy, 66.
Pediculus corporis (see *P. humanus*).
Pediculus humanus, in Abyssinia and Sudan, 129; in China, 131; in Manchuria, 108; and relapsing fever, 129, 131; experiments with relapsing fever and, 129, 131; conservation of typhus virus in bodies and excreta of, 60, 241; *Rickettsia rocha-limae* in, 192; experimental rearing of, 222; tests of extracts of *Stemona tuberosa* against, 61; text-book on medical importance, etc., of, 252.
Pediculus humanus capitinis, 252; secretion attaching eggs of, 248.
Pediculus vestimenti (see *P. humanus*).
peliliouensis, *Culicoides*.
 Pennyroyal, oil of, as repellent against *Musca domestica*, 251; toxicity of, to eggs of *Cochliomyia*, 259.
pensylvanica, *Parcoblatta*.
perazi, *Anopheles* (see *A. triannulatus*).
perfiliwei, *Phlebotomus*.
perilis, *Echidnophaga*.
Periplaneta americana, in houses in U.S.A., 128.
Periplaneta fuliginosa, in houses in U.S.A., 128.
perniciosus, *Phlebotomus*.
Peromyscus, acquired immunity from ticks in, 172.
Peromyscus californicus insignis, experiments with *Trypanosoma cruzi* and, 132.
 Persia, ticks and relapsing fever in, 150.
 Persian Gulf, Anophelines and malaria in islands in, 153.
persica, *Spirochaeta*.
persicus, *Argas*.
persestans, *Filaria* (*Acanthocheilonema*).
persulcatus, *Ixodes*.
perturbans, *Mansonia*.

- Peru, *Phlebotomus* and verruga in, 25, 106.
peruensis, *Phlebotomus*.
peruvianus, *Dermestes*.
pestis, *Bacillus (Pasteurella)*.
 Petechial Fever (of cattle, etc.), experiments with Arthropods and, in Kenya, 88.
petragnani, *Anopheles claviger*.
petrochiae, *Fannia*.
 Phantomyst Sprayer, for aircraft, 48, 49, 119.
pharoensis, *Anopheles*.
Pheidole, destroying *Cochliomyia hominivorax* in U.S.A., 156.
Pheidole fallax jelskii var. *antillensis*, host of fowl tapeworm in Porto Rico, 190.
Pheidole vinelandica, host of fowl tapeworms in U.S.A., 58.
 Phenothiazine (see Thiodiphenylamine).
 Phenyl Salicylate, repellent to mosquitos, 203.
philipi, *Amblyomma*.
philippensis, *Anopheles*; *Spalangia*.
 Philippines, mosquitos and malaria in, 163, 164, 253; fly problem and refuse disposal in, 164, 165; household pests in, 268; pests and diseases of domestic animals in, 268.
Philonthus scribae, destroying fleas in rodent burrows in Russia, 59, 171.
Phlebotomus, in Abyssinia, 34, 234; in Brazil, 66, 144, 245; relation of, to Brazilian visceral leishmaniasis, 66, 158, 245, 246; *Filaria bancrofti* in, in China and Crete, 82, 83; experimental transmission of verruga by, in Peru, 25; probably not transmitting Congo red fever, 202; not considered vectors of cutaneous leishmaniasis, 133; review of relation of, to disease, 189; bionomics of, 245, 246; rearing of, 245, 246; preparation of specimens of, 183, 184; classification and new species of, 5, 6, 16, 34, 106, 108, 144, 234, 269.
Phlebotomus arboris, in Ceylon, 6; female of, 6.
Phlebotomus argentipes, in Ceylon, 6.
Phlebotomus bailyi var. *campester*, in Siam, 6, 108; characters of, 6.
Phlebotomus barraudi, in India, 6; forms of, in Siam and Indo-China, 6, 108.
Phlebotomus barraudi var. *siamensis*, n., in Siam, 108.
Phlebotomus caucasicus, in Russian Union, 76; transmitting canine leishmaniasis, 76.
Phlebotomus congolensis, in Abyssinia, 234.
Phlebotomus cruzi, sp. n., in Brazil, 144.
Phlebotomus dureni, in Belgian Congo, 269; male of, 269.
Phlebotomus gigas, in Belgian Congo, 16; male of, 16.
Phlebotomus hivernus (see *P. iyengari* var. *hivernus*).
Phlebotomus intermedius, experiments with visceral leishmaniasis and, in Brazil, 245, 246.
Phlebotomus iyengari var. *hivernus*, status of, 6.
Phlebotomus iyengari var. *malayensis*, n., in Malaya, 6.
Phlebotomus langeroni var. *orientalis*, attacking man in Abyssinia, 34.
Phlebotomus lenti, sp. n., in Brazil, 144.
Phlebotomus longipalpis, in Brazil, 66, 245, 246; experiments with visceral leishmaniasis and, 245, 246.
Phlebotomus longipes, sp. n., in Abyssinia, 234.
Phlebotomus macedonicus (see *P. perfiliwei*).
Phlebotomus major, 246; difficulty of feeding sandflies of group of, through membranes, 199.
Phlebotomus martini, attacking man in Abyssinia, 34.
Phlebotomus minutus, in Crete, 83.
Phlebotomus mirabilis, sp. n., in Belgian Congo, 269.
Phlebotomus noguchii, doubtful relation of, to verruga in Peru, 106; identification of, 106.
Phlebotomus notatus, sp. n., in Abyssinia, 34.
Phlebotomus papatasii, in Crete, 83; associated with dermal leishmaniasis in Italy, 62, 142, 246; transmitting *Leishmania tropica* in Palestine, 108; difficulty of transmission of *L. tropica* by, 133; behaviour of *Leishmania* spp. in, 108, 199; technique of feeding, through membranes, 199; stages of digestion in, 96.
Phlebotomus papatasii var. *bergeroti*, diseases possibly transmitted by, in Abyssinia, 35,

- Phlebotomus perfiliewi*, and cutaneous leishmaniasis in Italy, 62, 142, 165, 246; experiment with cutaneous leishmaniasis and, 165.
- Phlebotomus perniciosus*, in Crete, 83; in Italy, 142, 246; associated with dermal leishmaniasis, 246; development of *Leishmania infantum* in, 200; characters of, 142.
- Phlebotomus peruvensis*, in Peru, 106.
- Phlebotomus schwetzi*, in Belgian Congo, 202.
- Phlebotomus schwetzi* var. *aethiopicus*, in Abyssinia, 34, 35.
- Phlebotomus sergenti*, in Crete, 83, 108; transmitting *Leishmania tropica*, 108; difficulty of transmission of *L. tropica* by, 133; difficulty of feeding, through membranes, 199.
- Phlebotomus squamipleurus*, in Abyssinia, 34; in Siam, 108.
- Phlebotomus squamipleurus* var. *indicus*, in Ceylon, 6.
- Phlebotomus squamipleurus* var. *inermis*, in Abyssinia, 234.
- Phlebotomus stantoni*, in Ceylon, 6.
- Phlebotomus subtilis*, sp. n., in Abyssinia, 234.
- Phlebotomus texanus*, sp. n., in ants' nest in U.S.A., 144.
- Phlebotomus vagus*, sp. n., in Abyssinia, 234.
- Phlebotomus verrucarum*, and veruga in Peru, 106; habits and identification of, 106.
- Phlebotomus viator*, sp. n., in Abyssinia, 234.
- Phlebotomus viduus*, in Abyssinia, 35.
- Phlebotomus wansoni*, in Belgian Congo, 269; female of, 269.
- Phlebotomus wurtzi*, sp. n., in Abyssinia, 34.
- Phlebotomus zeylanicus*, in Ceylon, 5.
- Phormia*, variations in prevalence of, in U.S.A., 104, 156; experiment in trapping, 104.
- Phormia groenlandica* (see *P. terraenovae*).
- Phormia regina*, in U.S.A., 101, 104; infesting domestic animals, 101; intestinal myiasis not caused by, 108.
- Phormia terraenovae*, effect of over-crowding on larvae of, 174, 175.
- Photographs, use of, in testing fly-sprays, 24.
- Phragmites communis*, *Anopheles maculipennis* associated with, 75.
- Phthirus pubis*, account of, 252; extracts of *Stemona tuberosa* toxic to, 81.
- Pickleweed (see *Batis maritima*).
- pictipes*, *Simulium*.
- Pigs, Anophelines feeding on, 71, 73, 74, 123, 162, 163; use of, against Anopheline larvae, 164; ticks on, 219, 241, 243; tularaemia in, 241; *Musca domestica* breeding in dung of, 89.
- pilularius*, *Canthon*.
- Pine Oil, repellent to mosquitos, 203.
- Pine-tar Oil, in mixtures against *Amblyomma* and blowflies, 101, 258.
- pipiens*, *Culex*.
- Piroplasma bigeminum*, in cattle in Kenya, 159, 160; relation of ticks to, 160.
- Piroplasma bovis* (in cattle), ticks transmitting, in Britain, 242, 269; in Yugoslavia, 188; in eggs of *Ixodes ricinus*, 188.
- Piroplasmosis, in domestic animals in India and Philippines, 5, 268; not transmitted by *Haemaphysalis bispinosa*, 249. (See *Piroplasma* and *Theileria*.)
- Pistia*, relation of *Mansonia* to, 45, 46, 178, 187, 255.
- Pitcher-plant, mosquito breeding in 256.
- Plague, in China, 91, 235, 236; in Belgian Congo, 186; in India, 9, 10; in Netherlands Indies, 176; in Manchuria, 109; in Russian Union, 59, 60; in U.S.A., 106, 204; and fleas, 10, 59, 60, 92, 106, 109, 136, 189, 204, 235, 236, 237; persistence of, in fleas, 59, 60, 106, 109, 237; experiments with fleas and, 236, 237; medium for studying, in fleas, 136; experiments with *Triatoma rubrofasciata* and, 67; and rats, 10, 235, 236; and other rodents, 59, 60, 106, 204, 205, 236, 237; possible relation of flesh-eating birds to, 204.
- Plasmodium*, studies of exflagellation of, 78, 79.
- Plasmodium bubalis*, question of infection of Anophelines with, 40, 162.
- Plasmodium cynomolgi*, not experimentally transmitted to man, 16.
- Plasmodium falciparum*, in Brazil, 228; in India, 6; experiments with Anophelines and, 79, 186,

- 194 ; effect of drugs on infection of Anophelines with, 115, 152 ; method of staining oocysts of, in mosquitos, 247 ; *P. reichenowi* compared with, 193, 246 ; *P. vivax* not immunising against, 194.
- Plasmodium gallinaceum*, transmitted by *Aedes geniculatus*, 176.
- Plasmodium malariae*, *P. rodhaini* resembling, 193.
- Plasmodium ovale*, experiments with Anophelines and, 186.
- Plasmodium reichenowi* (in apes), studies on, 193, 246.
- Plasmodium rodhaini*, sp. n., in apes, 193.
- Plasmodium schwetzi*, sp. n. (in apes), studies on, 193, 246.
- Plasmodium vivax*, in Brazil, 228 ; in Holland, 27 ; in India, 6 ; in Italy, 27 ; in Morocco, 78 ; experiments with Anophelines and, 74, 79, 132, 186, 194, 228, 232 ; effect of temperature on development of, in *Anopheles maculipennis*, 74 ; protracted latency of, in man, 144 ; *P. falciparum* not immunising against, 194 ; *P. schwetzi* compared with, 193, 246.
- Platyprosopus elongatus*, destroying fleas in rodent burrows in Russia, 59.
- pleccau*, *Anopheles lindesayi*.
- Plistophora*, in mosquito larvae in India, 8.
- plumbeus*, *Anopheles*.
- Poland, Anophelines in, 186 ; *Hypoderma* in cattle in, 16.
- pollex*, *Ctenophthalmus*.
- Polygonum flaccidum*, action of, as a mosquito larvicide, 208.
- Polyplax spinulosa*, experiments with leprosy and, 262.
- Porto Rico, campaign against *Bonellus* in, 145 ; natural enemies and biological control of Muscoid flies in, 158, 187, 190 ; insect host of fowl tapeworm in, 190 ; list of parasites of animals in, 269.
- Portugal, Anophelines in, 185, 233 ; malaria in, 185.
- Potamogeton natans*, *Mansonia perturbans* associated with, 214.
- Prawns, destroying mosquito larvae in Tanganyika, 90.
- pretoriensis*, *Anopheles*.
- prociduus*, *Copris incertus*.
- Proechimys oris*, doubtful relation of, to Brazilian visceral leishmaniasis, 66, 158.
- profundale*, *Danubiosimulium columbacense*.
- prolixus*, *Rhodnius*.
- Prosthogonimus macrorchis* (in poultry), insect hosts of, in N. America, 247.
- Proteus chandleri*, sp. n., associated with *Cochliomyia hominivorax*, 4, 218.
- protracta*, *Triatoma*.
- prowazeki*, *Rickettsia*.
- pruna*, *Musca* (*Orthellia*).
- pseudopictus*, *Anopheles hyrcanus*.
- pseudopunctipennis*, *Anopheles*.
- Psorophora*, bionomics of, in Arkansas, 257, 258 ; in Brazil, 193 ; experimental feeding of, 193.
- Psorophora albipes*, in Brazil, 13, 224 ; characters and status of, 13, 224.
- Psorophora ciliata*, in Arkansas, 257.
- Psorophora columbiae*, bionomics of, in Arkansas, 257.
- Psorophora cyanescens*, in Arkansas, 257.
- Psorophora discolor*, in Arkansas, 257.
- Psorophora ferox*, in Brazil, 193.
- Psorophora forceps*, sp. n., in Brazil, 224.
- Psorophora lutzi*, in Brazil, 13, 224 ; characters of, 224 ; *P. albipes* distinct from, 13.
- Psoroptes caprae*, measures against, on goats in India, 147.
- Psoroptes ovis*, bionomics of, on sheep in Kenya, 89.
- Pterostichus*, host of fowl tapeworm in U.S.A., 146.
- pubis*, *Phthisirus*.
- pulchellus*, *Rhipicephalus*.
- pulcherrimus*, *Anopheles*.
- pulchrifalpis*, *Orthopodomyia*.
- pulchrithorax*, *Aedes* (*Finlaya*).
- Pulex irritans*, on rats in China, 92, 235 ; in Japanese Empire, 256, 257 ; on cats and dogs in Manchuria, 108 ; *Filaria bancrofti* not developing in, 257 ; and plague, 92.
- pumila*, *Musca*.
- punctata*, *Haemaphysalis cinabarina*.
- punctimacula*, *Anopheles*.
- punctipennis*, *Anopheles*.
- punctor*, *Aedes*.
- punctulatus*, *Anopheles*.
- purpureus*, *Rhinoestrus*.
- pusillus*, *Culicoides*.

Pyrethrum, extracts of, in sprays against mosquitos, 31, 49, 51, 90, 119, 138, 215; types and uses of extracts of, for spraying aeroplanes, 31, 49, 119, 215; water base for sprays of, 31, 49, 119, 138; action of extracts of, on flies and cockroaches, 18, 105; alpha naphthyl isothiocyanate increasing toxicity of, to flies, 57; preparation of fly-sprays from, 155; toxicity to flies of constituents of, 24; methods of determining pyrethrins in sprays containing, 64; standard solution of, for testing fly-sprays, 23; in repellents for blood-sucking Diptera, 14, 166, 203; use of, in mosquito larvicides, 156, 258; use of mosquito larvae for evaluating, 64; in mixture against ticks, 243.

Q.

quadrimaculatus, *Anopheles*.

Quail, ants destroying, in U.S.A., 102.

Quartan Malaria (see *Plasmodium malariae*).

quinquefasciatus, auct., *Culex* (see *C. fatigans*).

R.

Rabbits, spirochaete in Anopheline fed on, 232; *Echidnophaga* spp. on, 205; tick on, 243; acquired immunity from ticks in, 172, 199; Brazilian exanthematic typhus in, 36.

Rabies, virus of, in *Rhipicephalus sanguineus*, 194.

Raiillietina spp. (fowl tapeworms), insect hosts of, in U.S.A. and Porto Rico, 58, 146, 190.

Railways, control of Anophelines on, 33; plant for fumigating rolling stock of, 15.

Rana spp., mosquitos and *Foleyella* spp. in, 179, 231.

ranae, *Foleyella*.

Rats, *Dermacentor nuttalli* on, 240; fleas on, 10, 83, 87, 91, 92, 96, 108, 138, 235, 236, 237; lice on, 96, 262; mites infesting, 38, 96, 262; experiments with leprosy and parasites of, 262; and plague, 10, 235, 236; tularaemia in, 95.

Rattus (see *Mus*).

recurrentis, *Spirochaeta* (*Borrelia*).

Redwater (see *Piroplasma bigeminum* and *P. bovis*).

Refuse Disposal, methods of, against flies, 165.

regina, *Phormia*.

reichenowi, *Plasmodium*.

Relapsing Fever, in Abyssinia, 129; in Algeria, 36, 192; in Central Asia, 239; in China, 131; in Iraq and Palestine, 239; in Persia, 150; in Sudan, 129; in Syria, 238; in U.S.A., 4, 131, 140, 189; and lice, 129, 131, 252; experiments with lice and, 129, 130, 131, 140; and ticks, 4, 36, 131, 140, 150, 189, 192, 206, 239; experiments with ticks and, 131, 140, 141, 150, 239; experiments with ticks and louse-borne strain of, 129, 130; experiments with insects and tick-borne strain of, 140. (See *Spirochaeta* spp.)

Repellents, against blood-sucking Diptera, 14, 29, 124, 166, 202, 203; method of testing, on *Musca domestica*, 250.

reticulatus, *Dermacentor*.

Reviews:—Austen, E. E., The Housefly as a Danger to Health, 159; Burr, M., The Insect Legion, 178; Buxton, P. A., The Louse, 252; Crawford, R., Some Anopheline Pupae of Malaya, 234; Edwards, F. W., Oldroyd, H., & Smart, J., British Blood-sucking Flies, 243; Frickhinger, H. W., Elements of Pest Control, 238; Hartnack, H., 202 Common Household Pests of N. America, 156; Herms, W. B., Medical Entomology, with special reference to the Health and Well-being of Man and Animals, 189; Hunter, L., Domestic Pests, 113; Metcalf, C. L., & Flint, W. P., Destructive and Useful Insects, 262; Peus, F., The Fleas of Importance to Man, 169; Riley, W. A., & Johannsen, O. A., Medical Entomology, 40; Southwell, T., & Kirchner, A., A Guide to Veterinary Parasitology and Entomology, 89; Venkat Rao, V., & Ramakrishna, V., A Text Book on Malaria Control, 210; Weyer, F., The Vectors of Malaria, 139; Wigglesworth, V. B., The Principles of Insect Physiology, 169; A Handbook of Philippine Agriculture, 268. *Rhinoestrus purpureus*, in donkey in India, 147.

- Rhipicephalus*, species of, on sheep and goats in Italy, 39, 40; transmitting anaplasmosis of cattle, 160.
- Rhipicephalus appendiculatus*, relation of, to diseases of cattle in Kenya, 88, 160; effect of low temperature on, 88.
- Rhipicephalus bursa*, 40; in Yugoslavia, 149; relation of, to diseases of cattle in Kenya, 160; oviposition of, 194; poison in eggs of, 149.
- Rhipicephalus evertsi*, relation of, to diseases of cattle in Kenya, 88, 160.
- Rhipicephalus pulchellus*, not transmitting petechial fever in Kenya, 88.
- Rhipicephalus sanguineus*, transmitting *Spirochaeta hispanica* in Algeria, 38, 192; possible relation of, to exanthematic typhus of Brazil, 35, 36; in Guadeloupe, 35; in Italy, 39; in Jugoslavia, 149; transmitting Marseilles fever in Russia, 241; experiments with bovine anaplasmosis and, in U.S.A., 145; on dogs, 39, 194, 241; rabies virus in, 194; on sheep, 39; studies of, in relation to tick paralysis, 149, 150.
- Rhipicephalus simus*, 39; in Kenya, 88, 160; hereditary transmission of bovine anaplasmosis by, 160; not transmitting petechial fever, 88.
- Rhodesia, Northern, ticks and lice on cattle in, 94.
- Rhodesia, Southern, *Amblyomma hebraicum* in, 20; *Glossina* and trypanosomiasis in, 20, 200; other Muscoid flies in, 249.
- rhombeum*, *Trypanosoma*.
- rhombeum*, *Anopheles*.
- Rhodnius prolixus*, experiment with Rocky Mountain spotted fever and, 157; experiments with *Trypanosoma cruzi* and, 110, 264.
- Rice-fields, Anophelines breeding in, 7, 44, 72, 225, 233; other mosquitos associated with, 48, 256, 257; methods of oiling against mosquito larvae, 258; effect of Paris green on rice in, 123.
- ricinus*, *Ixodes*.
- Rickettsia*, review of data on, 252.
- Rickettsia prowazekii*, conservation of, in dead lice and louse excreta, 60.
- Rickettsia rocha-limae*, in *Pediculus humanus*, 192.
- Rift Valley Fever, experiments with mosquitos and, in Kenya, 88.
- riparis*, *Anopheles leucosphyrus*.
- Rivoltasia karamellahiei*, sp. n., on fowls in India, 160.
- rivulorum*, *Anopheles*; *Velia*.
- rocha-limae*, *Rickettsia*.
- Rocky Mountain Spotted Fever, in U.S.A., 237, 238; and ticks, 189, 237, 238; experiments with Triatomids and, 157; in dogs, 238; Brazilian exanthematic typhus possibly a form of, 35, 36.
- rodhaini*, *Cordylobia*; *Plasmodium rondoni*, *Anopheles*.
- Rotenone, action of sprays containing, on cockroaches, 18; in wash against *Hypoderma*, 145; action of, on mosquito larvae, 232.
- rotundatus*, *Gnathoncus*.
- rubicundus*, *Ixodes*.
- rubrofasciata*, *Triatoma*.
- Rue, toxicity of oil of, to eggs of *Cochliomyia*, 259.
- rufifacies*, *Chrysomyia*.
- rufipes*, *Anopheles*.
- Rumania, Anophelines and malaria in, 253-255; *Hypoderma bovis* in cattle in, 198.
- Ruppia maritima*, value of, in marshes, 216.
- Russian Union, Anophelines in, 67, 68, 69, 70-76, 113, 114, 127, 173, 174, 175, 180-188, 184, 218, 220, 221, 222, 223, 224; other mosquitos in, 70, 184; Gastropod destroying Anopheline larvae in, 76; attempted acclimatisation of *Lebistes* against mosquito larvae in, 76, 77; malaria in, 70, 71, 72, 73, 74, 127, 181, 182, 220, 221, 223; *Phlebotomus* and leishmaniasis in, 76; *Musca domestica* in, 69; fleas on rodents in, 59, 60, 170, 171; beetles destroying fleas in rodent burrows in, 59, 171; plague in, 59, 60; ticks in, 70, 219, 239, 240, 241, 242; relapsing fever in, 239; talga encephalitis in, 69, 70, 239, 240; tularaemia in, 241; typhus-group fevers in, 240, 241.
- Ruwenzori Expedition, Diptera and fleas collected by, 225.
- S.
- Sabathes*, in Brazil, 193; experimental feeding of, 193.

- Sabothoides*, associated with yellow fever in Brazil, 121.
sacharovi, *Anopheles maculipennis*.
 Sakhalin, Oedemerid causing dermatitis in, 143.
Salvinia natans, relation of *Mansonia* to, 255.
sancii-elii, *Anopheles*.
 Sandflies (see *Culicoides* and *Phlebotomus*.)
 Sandfly Fever, 189; disease resembling, in Abyssinia, 35.
sanguineus, *Rhipicephalus*.
 Saponin, plants containing, as mosquito larvicides, 208.
Saprolegnia, on Simuliid pupae, 250.
Sarcophaga, in Netherlands Indies, 16; in Philippines, 164; terminalia of, 16; *Helicobia australis* compared with, 37.
Sarcophaga alcedo, in U.S.A., 167; bionomics of, parasitising Coprids, 167, 168.
Sarcophaga barbata, infesting man in Argentina, 266.
Sarcophaga haemorrhoidalis, 16; breeding in faeces in Hungary, 134.
Sarcophaga securifera, intestinal myiasis not caused by, 108.
Sarcopromusca arcuata (see *Musca pruna*).
Sarcopsylla, plague in, in Belgian Congo, 186.
 Sassafras, toxicity of oil of, to eggs of *Cochliomyia*, 259.
savignyi, *Ornithodoros*.
scalaris, *Fannia* (*Homalomyia*).
scapularis, *Aëdes*.
scarabaeoides, *Sphaeridium*.
Schizotrypanum (see *Trypanosoma*).
schwetzi, *Phlebotomus*; *Plasmodium*.
Scirpus cyperinus, *Mansonia perturbans* associated with, 214.
Scirpus lacustris, *Anopheles maculipennis* associated with, 75.
Scirpus olneyi, value of, in marshes, 216.
 Scorpions, in Mexico, 96; in Trinidad, 269.
 Screening, against mosquitos, 131, 164; materials for, 181.
scribæ, *Philonthus*.
scutellaris, *Aëdes*.
securifera, *Sarcophaga*.
segnis, *Leptopsylla*.
Seuratulus atramaculatus, destroying Simuliid larvae in Canada, 250.
semura, *Frontopsylla*.
- Senecio cremeiplorum*, utilisation of, against *Anopheles pseudopunctipennis*, 18.
sergenti, *Anopheles*; *Phlebotomus*.
sericata, *Lucilia*.
serratus, *Aëdes*.
setosa, *Neopsylla*.
 Sheep, blowflies infesting, 61, 62, 99, 105, 135, 136, 195-198, 249, 265; factors affecting infestation of, by blowflies, 112, 135, 196, 197; operation reducing susceptibility of, to blowflies, 62, 136, 197, 198; experimentally infested by *Helicobia australis*, 37; *Hypoderma aeratum* in, 100; experimental infestation of, by *Hypoderma* from cattle, 21; *Oestrus ovis* in, 99, 145; *Melophagus ovinus* on, 99, 196, 242; mosquitos transmitting tularaemia to, 241; other blood-sucking Diptera attacking, 99, 249; lice on, 99, 196; *Psoroptes ovis* on, 89; relation of mites to tapeworm of, 145; ticks and tick-borne diseases of, 5, 39, 40, 99, 145, 190, 224, 237, 241, 242, 243, 249; toxicity of dipping fluids to, 206; experiments with *Trypanosoma rhodesiense* and, 19, 267; experiments with Rift Valley and petechial fevers and, 88.
Shelltox, 51.
 Shrews, fleas on, in China, 235.
 Siam, *Phlebotomus* spp. in, 6, 108.
siamensis, *Phlebotomus barraudi*.
 Sierra Leone, mosquitos in, 65, 130, 131; *Coelomomyces* infesting Anophelines in, 65.
silvarum, *Dermacentor*.
similis, *Leptus* (see *Trombicula alfreddugèsi*).
simondi, *Leucocytozoon*.
simplex, *Simulium*.
simpsoni, *Aëdes*.
simulii, *Nosema* (see *Thelohania varians*).
 Simuliids, possibly transmitting *Spirochaeta carateum* in Tropical America, 195; of British Isles, 243; predators and parasites of, in Yugoslavia and Canada, 15, 16, 250; in Uganda, 176, 226; and onchocercosis, 155, 176, 189; transmitting *Leucocytozoon* to poultry, 189; repellents for, 14; cones for collecting, 244.
Simulium bisnovem, in Uganda, 226.
Simulium cervicornutum, in Uganda, 226.

- Simulium damnosum*, bionomics of, in Belgian Congo, 202; associated with onchocercosis in Nyasaland, 155; in Uganda, 226.
Simulium debegene, in Uganda, 226.
Simulium dentulosum, in Uganda, 226.
Simulium duodecimum, in Uganda, 226.
Simulium griseicollis, in Belgian Congo, 202.
Simulium kauntzeum, in Uganda, 226.
Simulium lepidum, in Uganda, 226.
Simulium multidentatum, *Mermis* in larvae of, in Canada, 250.
Simulium neavei, in Kenya, 267.
Simulium nigroparvum, digestive tract of, 64.
Simulium pictipes, mite infesting, in Canada, 250.
Simulium simplex, in Kenya, 267.
Simulium taylori, in Uganda, 226.
Simulium venustum, *Mermis* in larvae of, in Canada, 250.
Simulium vittatum, fish destroying, in Canada, 250.
simus, *Rhipicephalus*.
sinensis, *Anopheles hyrcanus*.
sintonoides, *Anopheles*.
Siphunculina funicola, bionomics of, in India, 208; conjunctivitis probably spread by, 208; illustrations to article on, 64.
Sleeping Sickness, in E. Africa, 41, 98, 188, 261, 266; in Nigeria, 97, 266; in S. Rhodesia, 200; in Anglo-Egyptian Sudan, 266; in Fr. Sudan, 263, 264; and *Glossina*, 41, 97, 188, 200, 201, 264, 266; *Glossina* possibly producing immunity from, 201; doubtful relation of, to game, 200, 201. (See *Trypanosoma gambiense* and *T. rhodesiense*.)
Soap, in washes against *Hypoderma*, 145, 165.
Sodium Arsenite, repeated use of solution of, for jetting sheep against blowflies, 265.
Sodium Cyanide, experiments with, against *Solenopsis*, 102.
Sodium Fluoride, reactions of *Musca domestica* to, 103.
Sodium Fluosilicate, reactions of *Musca domestica* to, 103.
Sodium Polysulphide Dips, tests of toxicity of, to animals, 206.
sogdianus, *Anopheles*.
Solenopsis, bionomics of, destroying quail in U.S.A., 102; experiments against, 102.
Solenopsis geminata, 102.
sollicitans, *Aedes*.
Somaliland, British, new tick in, 96.
sorbens, *Musca*.
sordida, *Eutriatoma (Triatoma)*.
Spain, *Anopheles maculipennis* in, 218; fungus parasites of mosquitos in, 96.
Spalangia drosophilae, parasite of *Lyperosia irritans* in Porto Rico, 190.
Spalangia muscidarum, hosts of, in Porto Rico, 190.
Spalangia philippinensis (parasite of *Lyperosia*), in Hawaii, 190; introduced into Porto Rico, 190; other hosts of, 190.
Speotyto cunicularia, importance of, in relation to rodent fleas and plague, 205.
Sphaeridium scarabaeoides, introduced into Hawaii against *Lyperosia irritans*, 135.
spicatus, *Gomphus*.
Spiders, Poisonous (see *Latrodectus*).
Spirochaeta, list of species of, transmitted by ticks, 205, 206.
Spirochaeta anserina (in poultry), in Albania, 40; in Australia, 63; in India, 5; transmitted by *Argas persicus*, 5; forms of, in *A. persicus*, 40; *Dermanyssus gallicus* transmitting, 63.
Spirochaeta babylonensis, sp. n., in Iraq, 239; ticks transmitting, 239.
Spirochaeta caratea, sp. n., in man in Tropical America, 195, 269; possible vectors of, 195.
Spirochaeta culicis, spirochaete resembling, in *Anopheles maculipennis* in Britain, 232.
Spirochaeta duttoni, studies on transmission of, by *Ornithodoros moubata*, 111, 141, 142; transmission of, by Mexican tick, 239; experiments with *Lyponyssus* and, 128, 257; experiments with *Triatoma infestans* and, 67.
Spirochaeta hispanica, ticks transmitting, in Mediterranean Basin, 38, 192, 239; *S. babylonensis* compared with, 239.
Spirochaeta morsus-muris, experiment with *Cimex lectularius* and, 140.
Spirochaeta recurrentis, 140; experiments with *Pediculus humanus* and, 131.
Spirograma, Anopheline larvae associated with, 13, 30, 122, 233, 247; elimination of, against *Anopheles pseudopunctipennis*, 13.

- splendens*, *Megarhinus*.
splendidus, *Anopheles*.
 Sprays (see Fly-sprays).
squamipleuris, *Phlebotomus*.
squamosus, *Anopheles*.
stabulans, *Muscina*.
stagnorum, *Hydrometra*.
stantoni, *Phlebotomus*.
 Staphylinids, keys to, in nests of birds and mammals in Russian Union, 59; destroying fleas in rodent burrows, 59, 171.
Staphylococcus aureus, action of washings of maggots on, 195.
Stegomyia (see *Aëdes*).
stellifer, *Culicoides*.
Stemona tuberosa, tests of extracts of, against lice, 61.
stenopsis, *Linognathus*.
Stenoterys fulvoventralis (see *Tachinaephagus zealandicus*).
stephensi, *Anopheles*.
sticticus, *Aëdes*.
Stilobezzia, synonymy of, 84.
stimulans, *Aëdes*.
 Stoats, *Ixodes ricinus* on, 243.
 Stomoxydinae, classification of, 120.
Stomoxys, negative experiment with petechial fever and, in Kenya, 88; habits of, in S. Rhodesia, 249; doubtful relation of, to *Filaria immitis* in U.S.A., 230, 231.
Stomoxys calcitrans, sheep killed by, in Basutoland, 99; breeding habits of, in Jugoslavia, 168; in U.S.A., 145, 231; doubtful relation of, to equine encephalomyelitis, 145; mechanical transmission of *Leishmania tropica* by, 133, 134, 200; experimentally transmitting tularaemia, 241; equipment for feeding, 56; carriage of, in aeroplanes, 215; effect of pyrethrum spray on, 105; *Lyperosia irritans* compared with, 155.
Streptococcus mastitidis, action of washings of maggots on, 195.
striatum, *Amblyomma*.
strodei, *Anopheles*.
subalpinus, *Anopheles maculipennis*.
subpictus, *Anopheles*.
subtilis, *Phlebotomus*.
 Sudan, Anglo-Egyptian, mosquitos in, 47, 87; malaria in, 87; experiment with *Gambusia* in, 87; *Glossina* in, 87, 266; sleeping sickness in, 266; lice and relapsing fever in, 129; *Xenopsylla nubica* on rats in, 87.
 Sudan, French (see Africa, French West).
 Sudan III, use of, in testing fly-sprays, 268.
 Sulphur, fumigation with, against *Pediculoides ventricosus*, 151; toxicity to animals of dips containing, 206.
sundaicus, *Anopheles*.
Supella supellectilium, distribution of, in houses in U.S.A., 55, 56, 128; control of, by high temperature, 55.
superpictus, *Anopheles*.
 Surra, and Tabanids in Philippines, 268.
sururifer, *Gnathoncus rotundatus*.
 Sweden, mosquitos in, 26, 95, 128, 138; malaria in, 26; question of vectors of tularaemia in, 95, 138.
 Sweet Birch, toxicity of oil of, to eggs of *Cochliomyia*, 259.
swynnertoni, *Glossina*.
sylviarum, *Liponyssus*.
Sylvilagus minensis, Brazilian exanthematic typhus in, 36.
 Syria, relapsing fever in, 238.

T.

- Tabanids, of Italian East Africa, 142, 188; of British Isles, 243; of Manchuria, 143; (Tabaninae), of Nearctic Region, 64; of Palaearctic Region, 192; in Savoy Alps, 192; and surra, 268; and tularaemia, 241; new species of, 64, 142, 192.
Tabanus, *Filaria immitis* not found in, in Massachusetts, 230.
Tachinaephagus zealandicus (australiensis), parasite of blowflies in Australia and New Zealand, 169; synonymy of, 169.
tachinoides, *Glossina*.
taeniorhynchus, *Aëdes*.
 Talc, as a carrier for mosquito larvicides, 68.
 Tanganyika Territory, Anophelines and malaria in, 31, 32, 89, 90; natural enemies of mosquito larvae in, 90; *Glossina* and trypanosomiasis of man and animals in, 19, 188, 266.
 Tar Distillates, use of, against *Cimex lectularius*, 62; as repellents for mosquitos, 203.
tarsimaculatus, *Anopheles*.
taylori, *Simulium*.

- Temperature, effects of : on insects, 1, 2, 56, 77, 104, 156, 172, 174, 235, 236, 262 ; on disease organisms in mosquitos, 74, 79, 179, 238 ; on action of oils on mosquito larvae, 12 ; on ticks, 88, 191, 219 ; on *Theileria parva* in ticks, 89. (See Heat.)
- tenebrosus*, *Anopheles coustani*.
- Tephrosia candida*, 208.
- Tephrosia vogelii*, extract of, as a mosquito larvicide, 208.
- terraenovae*, *Phormia*.
- terrens*, *Aedes*.
- territans*, *Culex*.
- tesquorum*, *Ceratophyllus*.
- tetragona*, *Raillietina*.
- Tetramorium caespitum*, host of fowl tapeworms in U.S.A., 58.
- Tetranychus tlalsahuatl* (see *Trombicula autumnalis*).
- texana*, *Atta*.
- texanus*, *Ixodiphagus* ; *Phlebotomus*.
- Theileria parva*, experiments with ticks and, in Kenya, 89.
- Thelohania*, in mosquito larvae in India, 8.
- Thelohania varians*, in Simuliid larvae in Canada, 250.
- Theobaldia*, seldom parasitised by *Arrenurus* in Germany, 27 ; probably not transmitting encephalitis in Russian Far East, 70.
- Theobaldia alaskaensis*, bionomics of, in Sweden, 128.
- Thermodes Hot Air Process, 143.
- Thiocyanates, action and use of, in sprays against insects, 18, 57, 251 ; toxicity of, to mammals, 251.
- Thiodiphenylamine, tests of preparations containing, against mosquito larvae, 58.
- tholozani*, *Ornithodoros*.
- Thyme, oil of, in repellent for blood-sucking Diptera, 14, 203.
- Thymol, unsuitable as repellent for mosquitos, 203.
- Tick Paralysis, 99, 149, 172 ; distribution in ticks of agent causing, 149, 150.
- Tick-borne Fever (of sheep), *Ixodes ricinus* transmitting, in Britain, 242.
- Ticks, study of collections of, from S. America and Trinidad, 175 ; of Argentina, 94 ; survey of species of, on domestic animals in Britain, 268 ; of Burma, 248 ; importance of, on domestic animals in Germany, 40 ; of Guadeloupe, 35 ; of Yugoslavia, 149 ; records of, in Libya, 63 ; relation of, to encephalitis in Russian Union, 69, 70, 239, 240 ; causing paralysis in man, 172 ; distribution in, of agent causing paralysis, 149, 150 ; and relapsing fever, 4, 36, 111, 181, 140, 141, 150, 189, 192, 206, 239, 252 ; experiments with types of relapsing fever and, 129, 130, 140, 141 ; new spirochaete possibly transmitted by, in Tropical America, 195 ; and tularemia, 95, 148, 188, 189, 237, 241 ; and typhus-group fevers, 35, 36, 189, 237, 240 ; new infectious organism in, 146 ; and anaplasmosis, 5, 145, 160 ; and piroplasmosis, 5, 89, 160, 188, 242, 249, 268, 269 ; and other diseases of domestic animals, 88, 99, 145, 242 ; reviews of relation of, to disease, 146, 189, 205 ; rabies virus in, 194 ; poison in eggs of, 149 ; coxal fluid of, 141 ; intracellular bodies in, 248 ; oviposition of, 194 ; effects of temperature and humidity on, 88, 93, 191, 219, 242, 259 ; parasite of, 4 ; infestation by *Cochliomyia* associated with, 101 ; acquired immunity from, in rodents, 172, 199 ; measures against, 70, 93, 94, 101, 243 ; popular names of, 176 ; classification and new species of, 89, 40, 83, 96, 120, 160, 175, 176, 224. (See *Argas*, *Amblyomma*, *Boophilus*, *Ixodes* and *Ornithodoros*.)
- Tilapia nilotica*, destroying mosquito larvae in Tanganyika, 90.
- Timbo, treatment of mange with extracts of, 41.
- titillans*, *Mansonia*.
- Tityus trinitatis*, bionomics of, in Trinidad, 269.
- tlalsahuatl*, *Trombicula* (*Tetranychus*) (see *T. autumnalis*).
- Toads (see *Bufo*).
- togoi*, *Aedes*.
- toledoii*, *Ornithocoris*.
- Tortoises, *Hyalomma aegyptium* on, 40, 188 ; infected with tularemia, 188.
- transvaalensis*, auct. *Anopheles* (see *A. demeilloni*).
- Traps, for mosquitos, 193, 214, 215, 216, 228, 253 ; for Muscoid flies, 69, 103, 104, 196.
- Tree-holes, mosquitos breeding in, 68, 73, 75, 80, 127, 128, 151, 253.

- Trench Fever, transmitted by *Pediculus humanus*, 252.
- Treponema* (see *Spirochaeta*).
- triannulatus*, *Anopheles*.
- Triatoma infestans*, experiments on transmission of spirochaetes and bacteria by, 66; experiments with Rocky Mountain spotted fever and, 157; experiments with *Trypanosoma cruzi* and, 42, 110, 264.
- Triatoma pallidipennis*, associated with *Neotoma* in Mexico, 264; *Trypanosoma cruzi* in, 264.
- Triatoma protracta*, in U.S.A., 132, 157; and *Trypanosoma cruzi*, 132; experiments with Rocky Mountain spotted fever and, 157.
- Triatoma rubrofasciata*, experiments with plague and, 67.
- Triatoma sordida* (see *Eutriatoma*).
- trichopis*, *Culicoides*.
- Trichoprosopon*, associated with yellow fever in Brazil, 121, 193; experimental feeding of, 193.
- Trichoptera, attacking Simuliid larvae, 250.
- trichurus*, *Aedes*.
- Trimenopon jenningsi*, rickettsiae in, on guineapigs, 26.
- Trinidad, Ceratopogonids in, 228; scorpion in, 269; ticks in, 175.
- trinidadensis*, *Culicoides*.
- triseriatus*, *Aedes*.
- trisignatus*, *Anopheles albimanus*.
- tritaeniorhynchus*, *Culex*.
- Trombicula*, attacking man in Japanese Mandated Islands, 256.
- Trombicula alfreddugèsi*, synonymy of, attacking man in N. America, 5.
- Trombicula autumnalis*, synonymy of, attacking man in France, 5.
- Trombicula cinnabarinis* (see *T. alfreddugèsi*).
- Trombicula irritans*, Riley (see *T. alfreddugèsi*).
- Trombicula tlalsahuate* (see *T. autumnalis*).
- Trombicula vanommereni*, in Dutch Guiana, 63.
- Trombidium batatas*, doubtful identity of, 5.
- tropica*, *Leishmania*.
- tropicalis*, *Haemagogus*.
- Trypanosoma brucei*, in *Glossina* and domestic animals in Uganda, 41; question of relation of *T. rhodesiense* to, 19, 200.
- Trypanosoma congolense*, in cattle in Nyasaland, 260; experiments with *Glossina morsitans* and, 176.
- Trypanosoma cruzi*; in Brazil, 94, 110; in Mexico, 264; in U.S.A., 132; in Venezuela, 94; in man, 110, 264; and Triatomids, 94, 132, 189, 264; experiments with Triatomids and, 42, 110, 132; experiments with *Ornithodoros* spp. and, 183.
- Trypanosoma gambiense*, transmitted by *Glossina palpalis* in Uganda, 41; experiments with *G. morsitans* and, 65, 176, 191.
- Trypanosoma rhodesiense*, causing sleeping sickness in S. Rhodesia, 200; human carriers of, 201; experiments with *Glossina morsitans* and, in animals, 18, 19, 142, 143, 266; infectivity to man of strains of, 18, 19, 142, 267; question of relation of, to *T. brucei*, 19, 200; summary of research on, 270.
- Trypanosomiasis, of domestic animals, and *Glossina* in Africa, 20, 41, 188, 260; (*surra*), transmitted by Tabanids in Philippines, 268; of man in Africa (see Sleeping Sickness); American (see *Trypanosoma cruzi*).
- Tsetse Flies (see *Glossina*).
- Tsutsugamushi Disease, form of typhus resembling, in Russia, 240.
- Tularaemia, introduced into Italy, 14, 15; in Sweden, 95, 138; in Russian Union, 241; in Turkey, 148; in U.S.A., 237; in man, 95, 138, 148; in rodents, 14, 15, 95, 138, 241; in other animals, 188, 241; and mosquitos, 95, 138, 241; and ticks, 148, 188, 189, 237, 241; other possible or experimental vectors of, 95, 148, 241.
- tularensis*, *Bacterium*.
- Tunisia, Anophelines and malaria in, 118.
- turicata*, *Ornithodoros*.
- Turkey, question of vectors of tularaemia in, 148.
- turkudi*, *Anopheles*.
- Typha latifolia*, *Anopheles maculipennis* associated with, 75.
- typhosus*, *Bacillus*.
- Typhus (including endemic and tropical forms), tick transmitting, in Russian Union, 240; and fleas, 189; and lice, 252; conservation of virus of, in dead lice and louse excreta, 60, 241.

U.

Uganda, *Glossina* spp. in, 20, 41, 266; sleeping sickness in, 41, 266; other blood-sucking insects in, 176, 226; *Onchocerca volvulus* in, 176.
uhleri, *Eutriatoma*.
Ulosonia parvicornis, host of *Hymenolepis diminuta* in Argentina, 110.
umbrosus, *Anopheles*.
uniformis, *Mansonia* (*Mansonioides*).
United States of America, *Culicoides* in, 166, 217; mosquitos in, 28, 31, 105, 106, 121, 128, 151, 156, 161, 167, 191, 194, 214, 215, 216, 217, 230, 231, 257, 259; encephalitis in, 161; malaria in, 29, 30; new *Phlebotomus* in, 144; *Cochliomyia* and other blowflies in, 54, 101, 103, 104, 105, 156, 217, 218, 258, 269; ants destroying *C. hominivorax* in, 156; cockroaches in houses in, 55, 128; fleas on rodents and plague in, 106, 132, 204, 248; possible relation of flesh-eating birds to plague in, 204; Triatomids in, 132, 157; *Trypanosoma cruzi* in, 132; ticks in, 4, 63, 101, 120, 131, 133, 140, 145, 146, 160, 189, 224, 237; relapsing fever in, 4, 131, 140, 189; Rocky Mountain spotted fever and tularaemia in, 237; new virus in *Dermacentor andersoni* in, 146; parasite of ticks in, 4; pests and diseases of domestic animals in, 29, 31, 100, 101, 105, 145, 146, 156, 161, 194, 230, 258, 269; insect hosts of parasitic worms of fowls in, 58, 146, 247; ants destroying quail in, 102; *Foleyella* in frogs in, 178; books on pests in, 156, 262; (Washington State), catalogue of injurious Arthropods of, 203; Coprid introduced into Porto Rico from, 156, 167; Sarcophagid parasite of Coprids in, 187.
Urea, preparations containing, for treating wounds, 187.
Urease (in blowfly larvae), action of, in wounds, 199.

V.

vagans, *Culex*.
vagus, *Anopheles*; *Phlebotomus*.
vanommereni, *Trombicula*.

variabilis, *Dermacentor*.
varians, *Thelohania* (*Glugea*).
variegatum, *Amblyomma*.
varuna, *Anopheles*.
Velia rivulorum, predacious on Simuliids in Jugoslavia, 16.
Venezuela, Anophelines and malaria in, 43; *Trypanosoma cruzi* in *Eutriatoma maculata* in, 94.
ventricosus, *Pediculoides*.
venustum, *Simulium*.
verrucarum, *Phlebotomus*.
Verruga, and *Phlebotomus* in Peru, 25, 106, 189; experimental transmission of, by *Phlebotomus*, 25.
vestimenti, *Pediculus* (see *P. humanus*).
Veterinary Entomology and Parasitology, text-books on, 89, 189.
Veterinary Zoology, index catalogue of, 192.
vetustissima, *Musca* (see *M. pumila*).
vexans, *Aëdes*.
viator, *Phlebotomus*.
Vibrio cholerae, investigation on variation of, in flies, 169.
vicina, *Musca domestica*.
viduus, *Phlebotomus*.
Vinegar, in mixture against *Haematoxipinus asini*, 171.
vinelandica, *Pheidole*.
vishnui, *Culex*.
vittatum, *Simulium*.
vittatus, *Aëdes*.
vivax, *Plasmodium*.
Viviparomusca, considered a distinct genus, 65. (See *Musca*.)
volvulus, *Onchocerca*.
vomitoria, *Calliphora*.
vulpinus, *Dermestes*.

W.

walkeri, *Anopheles*.
wansoni, *Culicoides* (see *C. distinctipennis*).
Warble-flies (see *Hypoderma*).
Water Hyacinth (see *Eichhornia crassipes*).
Weasels, *Ixodes ricinus* on, 243.
Widgeon Grass (see *Ruppia maritima*).
Wild Duck, relation of mosquito control to, in marshes, 216.
Wohlfahrtia, revision of, 120; (and allied genera), terminalia of, 192.
Wolves, ticks on, in Russia, 242.
Wood Rats (see *Neotoma*).
Wool Grease, in mixture against ticks, 243.

- Worms, Parasitic, relation of, to insects, 58, 110, 146, 189, 190, 247; relation of, to mites, 145.
 Wright's Stain, for treating mosquito larvae, 80.
Wuchereria (see *Filaria*).
wurtzi, *Phlebotomus*.
Wyeomyia, associated with yellow fever in Brazil, 121, 193; experimental feeding of, 193.

X.

- Xanthochroa atriceps*, skin lesions caused by, in Japan, 143.
 Xenodiagnosis, 264.
Xenopsylla astia, on rats in India, 10.
Xenopsylla brasiliensis, plague in, in Belgian Congo, 136; on rats in India, 10.
Xenopsylla cheopis, in Brazil, 35; in China, 92, 235, 236; in England, 83; in Manchuria, 108; in India, 10; distribution of, in U.S.A., 132, 133; on rats, 10, 83, 92, 108, 133, 235, 236, 237; quantitative studies on biology of, 109; effects of temperature and humidity on, 109, 235, 236; and plague, 10, 92, 109, 235, 236, 237; experiments with plague and, 237; Brazilian exanthematic typhus not found in, 35.
Xenopsylla nubica, on rats in Sudan, 87.

- Xenopsylla occidentalis*, sp. n., in S. Africa, 192.

Y.

- Yaws, relation of Chloropids to, 189.
 Yellow Fever, in Brazil, 121, 193; in Colombia, 139; in Senegal, 160; possibility of introduction of, into Europe, 139; danger of introduction of, into India, 191, 225; risk of spread of, by aircraft, 48, 191; experiments with *Aedes aegypti* and vaccine virus of, 161; transmission of, by other naturally infected mosquitos, 121, 193; experimental mosquito vectors of, 121, 139, 191, 238; effect of temperature on transmission of, by *A. geniculatus*, 238; early paper on mosquitos and, 144; possible relation of non-biting Arthropods to, 151, 152; reviews of data on, 120, 139, 189, 191, 248.

Z.

- Zanthoxylum hamiltonianum*, extract of, as a mosquito larvicide, 208.
zealandicus, *Tachinaephagus zeylanicus*, *Phlebotomus*.
 Zyklon, used for HCN fumigation, 15.
 Zymothermic Cells, use of, in refuse disposal against flies, 165.

